

WATER TREATMENT PLANT

Beale AFB, California

**IFB NO.
SPECIFICATION NO.
DRAWING FILE NO.**

**DACA05-01-B-0001
1136
131-25-1307**



**US Army Corps
of Engineers
Sacramento District**

**DIRECTIVE NO. 1 Dated 05 Jun 99
PROJECT NO. 961005 R1**

Required Central Contractor Registration (CCR)

This solicitation incorporates DFARS Clause 252.204-7004, Required Central Contractor Registration. In accordance with this clause, you must be registered in the Department of Defense (DoD) CCR database in order to be eligible for contract award. If you intend to submit an offer for this procurement and are not already registered, you are urged to do so immediately via the Internet. The DOD CCR World Wide Web home page address is: <http://www.ccr2000.com>. The Defense Logistics Services Center also has a CCR web site at <http://www.ccr.dlsc.dla.mil/> which includes an instructional guide.

A "Data Universal Numbering System" (DUNS) number is a mandatory data element for registering. If you do not have a DUNS number, contact Dun and Bradstreet to obtain one at no charge. An offeror within the United States may call 1-800-333-0505. More information about the DUNS number is available from Dun and Bradstreet's Internet home page at <http://www.dnb.com/>.

A "Commercial and Government Entity" (CAGE) code is another mandatory data element for being registered in the CCR. However, if registration forms from USA companies are submitted without the CAGE code, one will be assigned as part of the Central Contractor Registration process.

DoD has established a goal of registering an applicant in the CCR database within 48 hours after receipt of a complete and accurate application via the Internet. However, registration of an applicant through a method other than the Internet may take up to 30 days.

Your prompt attention to this matter is vital. Offerors that are not registered should consider applying for registration immediately upon receipt of this solicitation.

TABLE OF CONTENTS

001	COVER SHEET
002	CENTRAL CONTRACTOR REGISTRATION (CCR)
003	TABLE OF CONTENTS
004	DD FORM 1707

SECTION	TITLE
00010	SOLICITATION, OFFER AND AWARD (STANDARD FORM 1442) AND PRICING SCHEDULE (005)
00100	INSTRUCTIONS, CONDITIONS AND NOTICES TO BIDDERS/ OFFERORS AND EVALUATION CRITERIA FOR AWARD
00600	REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF BIDDERS/OFFERORS
00700	CONTRACT CLAUSES
00800	SPECIAL CONTRACT REQUIREMENTS WAGE RATES

ATTACHMENTS:

ATTACHMENT NO.

1	NOT APPLICABLE
2	SUBMISSION OF EFT INFORMATION TO THE PAYMENT OFFICE
3	PREAWARD SURVEY
4	SUBCONTRACTING PLAN
5	DRAWING LIST
6	CONTRACTOR PREPARED AS-BUILTS

TECHNICAL SPECIFICATIONS

(SEE TECHNICAL SPECIFICATIONS' TABLE OF CONTENTS FOR
SPECIFICATION SECTIONS INCLUDED IN THIS SOLICITATION/CONTRACT)
DRAWINGS (SEPARATE PACKAGE) (LIST OF DRAWINGS-SECTION 00800)

NOTE: AS A MINIMUM ANY CONTRACT AWARDED AS A RESULT OF THIS
SOLICITATION SHALL CONSIST OF THE FOLLOWING DOCUMENTS:

STANDARD FORM 1442, SECTIONS 00010, 00700, 00800, TECHNICAL
SPECIFICATIONS AND DRAWINGS, AND ATTACHMENTS AS DESCRIBED IN
CONTRACT DOCUMENT.

SECTION 00600, AS COMPLETED BY AWARDEE, IS INCORPORATED INTO
ANY RESULTANT CONTRACT BY REFERENCE.

SECTION 00100 IS INCLUDED FOR SOLICITATION PURPOSES ONLY. THIS
SECTION WILL BE REMOVED, MAINTAINED IN THE CONTRACT FILE AND
NOT MADE PART OF THE CONTRACT.

AMENDMENTS ARE INCORPORATED INTO THE RESULTANT CONTRACT.

SUBCONTRACTING PLAN (IF REQUIRED) BECOMES AN ATTACHMENT TO AND A
MATERIAL PART OF THE CONTRACT

**INFORMATION TO OFFERORS OR QUOTERS
SECTION A - COVER SHEET**

*Form Approved
OMB No. 9000-0002
Expires Sep 30, 2000*

The public reporting burden for this collection of information is estimated to average 35 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (9000-0002), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS. RETURN COMPLETED FORM TO THE ADDRESS IN BLOCK 4 BELOW.

1. SOLICITATION NUMBER DACA05-01-B-0001	2. (X one)	3. DATE/TIME RESPONSE DUE MAY 10, 2001
	<input checked="" type="checkbox"/> a. INVITATION FOR BID (IFB)	
	<input type="checkbox"/> b. REQUEST FOR PROPOSAL (RFP)	
	<input type="checkbox"/> c. REQUEST FOR QUOTATION (RFQ)	

INSTRUCTIONS

NOTE: The provision entitled "Required Central Contractor Registration" is applicable to most solicitations.

1. If you are not submitting a response, complete the information in Blocks 9 through 11 and return to the issuing office in Block 4 unless a different return address is indicated in Block 7.
2. Responses must set forth full, accurate, and complete information as required by this solicitation (including attachments). "Fill-ins" are provided on Standard Form 18, Standard Form 33, and other solicitation documents. Examine the entire solicitation carefully. The penalty for making false statements is prescribed in 18 U.S.C. 1001.
3. Responses must be plainly marked with the Solicitation Number and the date and local time set forth for bid opening or receipt of proposals in the solicitation document.
4. Information regarding the timeliness of response is addressed in the provision of this solicitation entitled either "Late Submission, Modification and Withdrawal of Bid" or "Instructions to Offerors - Competitive Acquisitions".

4. ISSUING OFFICE (Complete mailing address, including ZIP Code) US ARMY ENGINEER DISTRICT SACRAMENTO ATTN: CONTRACTING DIV., RM 878 1325 J STREET SACRAMENTO, CA. 95814-2922	5. ITEMS TO BE PURCHASED (Brief description) SEE SF-1442, BLOCK 10 TYPE OF CONTRACT: SEE SECTION 00100 FAR CLAUSE 52.216-1
---	---

6. PROCUREMENT INFORMATION (X and complete as applicable)	
<input type="checkbox"/> a. THIS PROCUREMENT IS UNRESTRICTED	
<input type="checkbox"/> b. THIS PROCUREMENT IS _____ % SET-ASIDE FOR SMALL BUSINESS. THE APPLICABLE SIC CODE IS: _____	
<input type="checkbox"/> c. THIS PROCUREMENT IS _____ % SET-ASIDE FOR HUB ZONE CONCERNS. THE APPLICABLE SIC CODE IS: _____	
<input checked="" type="checkbox"/> d. THIS PROCUREMENT IS RESTRICTED TO FIRMS ELIGIBLE UNDER SECTION 8(a) OF THE SMALL BUSINESS ACT.	

7. ADDITIONAL INFORMATION

8. POINT OF CONTACT FOR INFORMATION	
a. NAME (Last, First, Middle Initial) SEE SECTION 00100	b. ADDRESS (Include Zip Code) SAME AS BLOCK 4 ABOVE
c. TELEPHONE NUMBER (Include Area Code and Extension) SEE SECTION 00100	d. E-MAIL ADDRESS SEE SECTION 00100

9. REASONS FOR NO RESPONSE (X all that apply)	
<input type="checkbox"/> a. CANNOT COMPLY WITH SPECIFICATIONS	<input type="checkbox"/> d. DO NOT REGULARLY MANUFACTURE OR SELL THE TYPE OF ITEMS INVOLVED
<input type="checkbox"/> b. UNABLE TO IDENTIFY THE ITEM(S)	<input type="checkbox"/> e. OTHER (Specify)
<input type="checkbox"/> c. CANNOT MEET DELIVERY REQUIREMENT	

10. MAILING LIST INFORMATION (X one)	
WE <input type="checkbox"/> DO <input type="checkbox"/>	DO NOT DESIRE TO BE RETAINED ON THE MAILING LIST FOR FUTURE PROCUREMENT OF THE TYPE INVOLVED.

11a. COMPANY NAME	b. ADDRESS (Include Zip Code)
-------------------	-------------------------------

c. ACTION OFFICER		(4) DATE SIGNED (YYYYMMDD)
(1) TYPED OR PRINTED NAME (Last, First, Middle Initial)	(2) TITLE	
(3) SIGNATURE		

FOLD

FOLD

FROM

AFFIX
STAMP
HERE

SOLICITATION NUMBER DACA05-01-B-0001	
DATE (YYYYMMDD)	LOCAL TIME

SOLICITATION, OFFER, AND AWARD <i>(Construction, Alteration, or Repair)</i>		1. SOLICITATION NO. DACA05-01-B-0001	2. TYPE OF SOLICITATION <input checked="" type="checkbox"/> SEALED BID (IFB) <input type="checkbox"/> NEGOTIATE (RFP)	3. DATE ISSUED 10-Apr-2001	PAGE OF PAGES 1 OF 197
IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.					
4. CONTRACT NO.		5. REQUISITION/PURCHASE REQUEST NO. W62N6M-1039-1594		6. PROJECT NO.	
7. ISSUED BY DEPARTMENT OF THE ARMY CORPS OF ENGINEERS, SACRAMENTO 1325 J STREET SACRAMENTO CA 95814-2922		CODE DACA05	8. ADDRESS OFFER TO <i>(If Other Than Item 7)</i> See Item 7		
TEL:		FAX:	TEL:		
9. FOR INFORMATION CALL:		A. NAME CHERYL GANNAWAY	B. TELEPHONE NO. <i>(Include area code)</i> (NO COLLECT CALLS) (916) 557- 6933		
SOLICITATION					
NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".					
10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS <i>(Title, identifying no., date):</i> WATER TREATMENT PLANT BEALE AFB, CALIFORNIA Spec. No. 1136 This project provides for construction of a new water treatment plant and supporting water transmission line/main connection with an existing water storage tank (facility # 4800; 500 TG). Effort will also include demolition of the existing inadequate Water Treatment Plant. The new water treatment plant will consist of a backwash water feed tank, storage tank, pressure filters, aerator/sumps and chemical feed/motor control building. The supporting water main will consist of approx. a 2000 LM line, supplementing the existing lines and new 18-inch bypass tie-in line (vicinity of base housing area). The plant work will also involve necessary site work, grading, paving, sidewalks, parking, infrastructure support, security fencing and security/parking lighting. The facility is needed to resolve water quality violations related to dissolved solids (iron and manganese) and gases (carbon dioxide, etc.) currently in the used well water source. This project is limited to 8(a) contractors whose approved business plan is on file with the SBA San Francisco District Office, and those firms having a bona-fide branch office within the area serviced by the San Francisco District. All other firms are deemed ineligible to submit.					
11. The Contractor shall begin performance within <u>10</u> calendar days and complete it within <u>350</u> calendar days after receiving <input type="checkbox"/> award, <input checked="" type="checkbox"/> notice to proceed. This performance period is <input checked="" type="checkbox"/> mandatory, <input type="checkbox"/> negotiable. <i>(See FAR 52.211-10)</i>					
12 A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? <i>(If "YES," indicate within how many calendar days after award in Item 12B.)</i> <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO					12B. CALENDAR DAYS 10
13. ADDITIONAL SOLICITATION REQUIREMENTS: A. Sealed offers in original and <u>0</u> copies to perform the work required are due at the place specified in Item 8 by <u>13:00:00</u> (hour) local time <u>5/10/01</u> (date). If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due. B. An offer guarantee <input checked="" type="checkbox"/> is, <input type="checkbox"/> is not required. C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference. D. Offers providing less than <u>90</u> calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.					

SOLICITATION, OFFER, AND AWARD (Continued)*(Construction, Alteration, or Repair)***OFFER (Must be fully completed by offeror)**14. NAME AND ADDRESS OF OFFEROR *(Include ZIP Code)*15. TELEPHONE NO. *(Include area code)*16. REMITTANCE ADDRESS *(Include only if different than Item 14)***See Item 14**

CODE

FACILITY CODE

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within _ calendar days after the date offers are due. *(Insert any number equal to or greater than the minimum requirements stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)*

AMOUNTS

SEE SCHEDULE OF PRICES

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS*(The offeror acknowledges receipt of amendments to the solicitation -- give number and date of each)*

AMENDMENT NO.

DATE

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN
OFFER *(Type or print)*

20B. SIGNATURE

20C. OFFER DATE

AWARD (To be completed by Government)

21. ITEMS ACCEPTED:

SEE SCHEDULE

22. AMOUNT

23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN
*(4 copies unless otherwise specified)***ITEM**

25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO

☐ 10 U.S.C. 2304(c)☐ 41 U.S.C. 253(c)

26. ADMINISTERED BY

CODE

27. PAYMENT WILL BE MADE BY

CODE

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

28. NEGOTIATED AGREEMENT *(Contractor is required to sign this document and return _____ copies to issuing office.)* Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this contract.

29. AWARD *(Contractor is not required to sign this document.)*

Your offer on this solicitation, is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED
TO SIGN *(Type or print)*31A. NAME OF CONTRACTING OFFICER *(Type or print)*

30B. SIGNATURE

30C. DATE

31B. UNITED STATES OF AMERICA
BY

31C. AWARD DATE

CONTINUATION OF STANDARD FORM 1442
BLOCK 20D:

(1) IF THE OFFEROR IS A JOINT VENTURE, EACH PARTICIPANT IN THE JOINT VENTURE MUST COMPLETE THE FOLLOWING:

_____ Company Name	_____ Signature	_____ Title
_____ Company Name	_____ Signature	_____ Title

NOTE: If a corporation is participating as a member of a Joint Venture, the certificate below must also be completed and signed.

CORPORATION AUTHORIZATION TO PARTICIPATE IN JOINT VENTURE CERTIFICATE

I, _____, certify that I am the Secretary of the
corporation
(name)
named as a participant in a Joint Venture on this offer; that
_____, who signed said offer on behalf of the corporation,
was
(name)
then _____ of said corporation; that the signature thereto
is
(title)
genuine; that said contract was duly signed, sealed and attested for and in
behalf of said corporation by authority of its governing body; and that the
corporation is authorized to participate in the Joint Venture on this offer.

(Name of Corporation)

(Secretary)

(2) IF THE OFFEROR IS A PARTNERSHIP, LIST FULL NAME OF ALL PARTNERS BELOW. SIGNATURES BY ALL PARTNERS HERE SIGNIFY THAT THE INDIVIDUAL WHO SIGNED THE OFFER IN BLOCK 20B HAS THE AUTHORITY TO BIND THE PARTNERSHIP.

_____ Name	_____ Signature
_____ Name	_____ Signature
_____ Name	_____ Signature

(3) IF THE OFFEROR IS A CORPORATION, THE OFFER SHALL BE SIGNED IN THE CORPORATE NAME FOLLOWED BY THE WORD "BY" AND THE SIGNATURE OF THE PERSON AUTHORIZED TO SIGN THE OFFER IN BLOCK 20B. PROVIDE PROOF THAT THE PERSON SIGNING FOR THE CORPORATION HAS THE AUTHORITY TO BIND THE CORPORATION BY COMPLETING THE FOLLOWING CERTIFICATE:

CONTINUATION OF STANDARD FORM 1442

CORPORATION AUTHORIZATION CERTIFICATE

I, _____, certify that I am the Secretary of
the

(name)

corporation named as offeror in the within offer; that

_____,

(name)

who signed said offer on behalf of the corporation, was then

_____ of said corporation, that the signature
(title)

thereto is genuine; that said contract was duly signed, sealed and attested
for in behalf of said corporation by authority of its governing body.

(Name of Corporation)

(Secretary)

(4) IF THE OFFEROR IS AN INDIVIDUAL DOING BUSINESS AS A FIRM, THE OFFER
SHALL BE SIGNED BY THAT INDIVIDUAL IN BLOCK 20B FOLLOWED BY THE WORDS "AN
INDIVIDUAL DOING BUSINESS AS _____ (INSERT
NAME OF FIRM).

(5) WHEN AN AGENT SIGNS THE OFFER, PROVIDE PROOF OF THE AGENT'S AUTHORITY TO
BIND THE PRINCIPAL.

PRICING SCHEDULE

BASE SCHEDULE

CONTRACTOR SHALL FURNISH ALL PLANT, LABOR, MATERIAL, EQUIPMENT, ETC.
NECESSARY TO PERFORM ALL WORK IN STRICT ACCORDANCE WITH THE TERMS AND
CONDITIONS SET FORTH IN THE CONTRACT TO INCLUDE ALL ATTACHMENTS THERETO.

LINE ITEM NO.	DESCRIPTION	QUANTITY	UNIT OF MEASURE	UNIT PRICE	TOTAL PRICE
0001	Construction of a Water Treatment Plant, Complete (Except Option Items Below)	1	LS	LUMP SUM	\$_____

BASE PRICE \$_____

OPTIONS

0002	Landscaping Extension (at Side of Water Treatment Plant)	1	LS	LUMP SUM	\$_____
------	--	---	----	----------	---------

0003	Paving	1	LS	LUMP SUM	\$_____
------	--------	---	----	----------	---------

0004	Automatic Salt Feed System.	1	LS	LUMP SUM	\$_____
------	--------------------------------	---	----	----------	---------

TOTAL PRICE \$_____
(TOTAL OF BASE
PRICE PLUS
ALL OPTIONS)

1. Prices must be submitted on all individual items of this Pricing Schedule. Failure to do so may be cause for rejection of bids.
2. The bidder/offeror shall distribute his indirect costs (overhead, profit, bond, etc.) over all the items in the Pricing Schedule. The Government will review all submitted Pricing Schedules for any unbalancing of the items. Any submitted Pricing Schedule determined to be unbalanced may be considered nonresponsive and cause the bidder to be ineligible for award.
3. The lump sum, "LS", line items above are not "estimated quantity" line items and therefore are not subject to the Variation in Quantity contract clause.
4. EFARS 52.214-5000 ARITHMETIC DISCREPANCIES (MAR 1995)
 - (a) For the purpose of initial evaluation of bids/offers, the following will be utilized in resolving arithmetic discrepancies found on the face of the Pricing Schedule as submitted by bidders/offerors:
 - (1) Obviously misplaced decimal points will be corrected;
 - (2) Discrepancy between unit price and extended price, the unit price will govern;
 - (3) Apparent errors in extension of unit prices will be corrected;
 - (4) Apparent errors in addition of lump-sum and extended prices will be corrected.
 - (b) For the purpose of bid/offer evaluation, the Government will proceed on the assumption that the bidder/offeror intends the bid/offer to be evaluated on basis of the unit prices, the totals arrived at by resolution of arithmetic discrepancies as provided above and the bid/offer will be so reflected on the abstract of bids/offers.
 - (c) These correction procedures shall not be used to resolve any ambiguity concerning which bid/offer is low.
5. The successful bidder/offeror grants the options listed in the Pricing Schedule to the Government. This option may be exercised any time up to 120 days after receipt of Notice to Proceed. Exercise of the option occurs upon mailing of written notice to the Contractor. Exercise will be made by the Contracting Officer. The price for exercise of the option includes all work and effort associated with the scope of that item. For determination of lowest bid, see paragraph titled EVALUATION OF OPTIONS in Section 00100 of this solicitation. No additional time for contract completion will be allowed when an option is exercised. The given contract completion time was formulated to include time necessary to perform all option work.

SECTION 00100 Bidding Schedule/Instructions to Bidders

CLAUSES INCORPORATED BY FULL TEXT

52.0214-4581**INQUIRIES (JUL 2000)**

Prospective bidders should submit inquiries related to this solicitation in accordance with the following (collect calls will not be accepted):

(1) For information related to ordering solicitation packages, amendments, the time and dates of bid openings, and for copies of the solicitation mailing list, please check our website at the following URL: <http://ebs.spk.usace.army.mil> If the site is temporarily unavailable, please FAX your inquiry to our Plan Room at (916) 557-7842

(2) For inquiries of a contractual nature (solicitation requirements, interpretation of contractual language):

Contract Specialist: Ms. Cheryl Gannaway
Telephone: (916) 557-6933
FAX: (916) 557-7854.

For bid results go to the Sacramento District, Contracting Division website <http://ebs.spk.usace.army.mil>. If this site has no bid information, call the Contract Specialist above.

(3) All **technical** questions on the specifications or drawings must be submitted in writing using one of the following:

MAILING ADDRESS:

Department of the Army
U.S. Army Engineer District, Sacramento
Contracting Division (Attn: Ms. Cheryl Gannaway)
1325 J Street
Sacramento CA 95814-2922

FAX: (916) 557-7854, Attn: **Ms. Cheryl Gannaway**

E-MAIL: cgannaway@spk.usace.army.mil AND mshupp@spk.usace.army.mil .

(4) Please include the solicitation number, the project title, the location of the project, the full name of your company and your telephone and FAX numbers in your correspondence. Written inquiries should be received by this office not later than 14 calendar days prior to the date set for bid opening.

(5) Oral explanations or instructions are not binding. Changes to the solicitation can only be made by an amendment to the solicitation.

52.0214-4582 DIRECTIONS FOR SUBMITTING BIDS/PROPOSALS (APR 1992)

Envelopes containing bids/offers must be sealed, marked and addressed as follows:

MARK ENVELOPES:

Solicitation No. DACA05-01-B-0001
Bid Opening/Offer Closing Date: May 10, 2001
Bid Opening/Offer Closing Time: 1:00 PM (LOCAL TIME)

ADDRESS ENVELOPES TO:

Department of the Army
U.S. Army Engineer District, Sacramento
Corps of Engineers
ATTN: Plan Room, Room 870
1325 J Street
Sacramento CA 95814-2922

Handcarried bids/proposals must be delivered to:

Room 878, Contracting Division Reception Area, at the above address by the date and time stated above.

Bidders/Offerors are cautioned to allow sufficient time for submission of handcarried bids/proposals. Security measures have been employed which will require all bids/proposals to be scanned prior to being submitted to the plan room depository. These measures are considered to be necessary to insure the safety of our personnel.

52.0209-4501 CONTRACTOR RESPONSIBILITY, PREAWARD SURVEY (JUL 1995)

In order to determine a contractor's responsibility for purposes of contract award in accordance with FAR Part 9, the contractor is required to provide a statement regarding previous experience and past performance in performing comparable work, information related to the business organization, financial resources, and/or plant to be used in performing the work (see Attachments, Preaward Survey). The Preaward Survey is attached to the solicitation for information purposes only. It will be required from only the low bidder. After the Bid Opening, the Government will request this information from the low bidder if the low bidder has not had a contract with the **Sacramento District** within the last twelve months and the Government will set a due date for its submission. The Preaward Survey is not required as part of the bid package. In order to be determined to be responsible a prospective contractor must:

- a. Have adequate financial resources to perform the contract or the ability to obtain them.
- b. Be able to comply with the required or proposed delivery or performance schedule, taking into consideration all existing commercial and governmental business commitments.
- c. Have a satisfactory performance record. In making the determination of responsibility, the Government Contracting Officer shall consider relevant past performance information. A prospective contractor shall not be determined responsible or nonresponsible solely on the basis of a lack of relevant performance history except when there are special standards set forth in the solicitation which applies to all bidders that must be met in order to receive the award. These special standards may be necessary when unusual expertise or specialized facilities are necessary in the performance of the contract; therefore, in order to be determined to be responsible for that particular contract, the offeror must be able to meet those special

standards. A prospective contractor that is or recently has been seriously deficient in contract performance shall be presumed to be nonresponsible unless the Contracting Officer determines that the circumstances were beyond the contractor's control or that the contractor has taken appropriate corrective action. Other responsibility considerations by the Contracting Officer will include past efforts by the contractor to apply sufficient tenacity and perseverance to perform acceptably, to meet quality requirements of contracts, and the contractor's past compliance with subcontracting plans (if required) under recent contracts.

d. Have a satisfactory record of integrity and business ethics.

e. Have the necessary organization, experience, accounting and operational controls, and technical skills, or the ability to obtain them (including, as appropriate, such elements as production control procedures, property control systems, quality assurance measures, and safety programs applicable to materials to be produced or services to be performed by the prospective contractor and subcontractors).

f. Have the necessary production, construction, and technical equipment and facilities, or the ability to obtain them.

g. Be otherwise qualified and eligible to receive an award under applicable laws and regulations.

If the contractor or subcontractor does not already have sufficient resources demonstrated in the completed Preaward Survey, acceptable evidence of "the ability to obtain" the required, adequate resources (all of the resources discussed in subparagraphs a, e, and f above) normally consists of a commitment or explicit arrangement that will be in existence at the time of contract award to rent, purchase or otherwise acquire the needed facilities, equipment, other resources, or personnel.

**52.0211-4805 AVAILABILITY OF CORPS OF ENGINEERS PUBLICATIONS
DESCRIPTIONS (AUG 1998)**

a. Corps of Engineers publications are available for inspection at the following location:

U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Engineering Division, District Library, 8th Floor
Sacramento, CA 95814-2922
Telephone Number (916) 557-6657

b. Construction Criteria Base (CCB). The Construction Criteria Base (CCB) system available through the National Institute of Building Sciences includes copies of Corps of Engineers methods and specifications. Documents that are available from this or other such sources will no longer be available directly from the Corps and should be obtained from those sources. Information about the CCB and ordering instructions can be obtained from:

National Institute of Building Sciences
1090 Vermont Ave., NW, Suite 700
Washington, D.C. 20005
Phone: 202/289-7800 (ask for CCB Information)

c. The Corps of Engineers manual, EM 385-1-1, Safety and Health Requirements Manual, is available on the Internet at the following location:
<http://www.usace.army.mil/inet/usace-docs/eng-manuals/em385-1-1/>.

52.0214-4503 EVALUATION FOR AWARD (JAN 1991)

The Government contemplates award of one contract to the responsive, responsible bidder who submits the low bid for the total of the following items in Pricing Schedule:

All line items listed in Pricing Schedule.

52.0214-4583 TELEGRAPHIC BIDS (JUL 2000)

TELEGRAPHIC BIDS/OFFERS ARE NOT ACCEPTABLE.

However, bids may be modified or withdrawn by written or telegraphic notice. Any telegram to modify or withdraw a bid sent to this office must be received in the office designated in the Invitation for Bids (IFB) for receipt of bids not later than the exact date and time set for bid opening. A telegraphic modification or withdrawal of a bid received in such office by telephone from the receiving telegraph office not later than the exact date and time set for bid opening shall be considered. However, the telephone message shall be confirmed by the telegraph company by sending a copy of the written telegram that formed the basis for the telephone call. The written telegram shall be sealed in an envelope by a proper official and sent to the office designated in the IFB for receipt of bids. The official shall write on the envelope (1) the date and time of receipt and by whom, and (2) the number of the IFB, and shall sign the envelope. The bidder is responsible to inform the telegraph company of these requirements. No one from this office will be dispatched to the local telegraph office to pick up any telegram for any reason.

52.0214-4584 FACSIMILE BIDS/OFFERS (APR 1992)

Facsimile bids/offers, modifications thereto, or cancellations of bids/offers will not be accepted.

52.0228-4504 PERFORMANCE AND PAYMENT BONDS (MAY 2000)

The bidder/offeror whose bid/offer is accepted will, within the time established in the contract, furnish performance and payment bonds in accordance with FAR 52.228-15 incorporated by reference in Section 00700.

52.0228-4506 INDIVIDUAL SURETIES IN SUPPORT OF BID BONDS (AUG 1991)

Bidders/offerors utilizing individual sureties in support of a bid bond shall include a Standard Form (SF) 28 (Affidavit of Individual Surety), accompanied by a pledge of acceptable assets from each person acting as an individual surety, and include these with the SF 24 (Bid Bond), and the bid itself (see clause titled "Pledges of Assets," FAR 52.228-11).

Pledges of acceptable assets shall be in the form of (1) evidence of an escrow account and/or (2) a recorded lien on real estate. If this is an IFB, failure to provide pledges of acceptable assets, with the bid, in the specified form, accompanied by a properly executed SF 24 and SF 28, will

render the bidder nonresponsible and thus ineligible for award. If this is an RFP, failure to provide required documentation described herein may cause the offeror to be deemed "unacceptable".

52.228-4507 BID GUARANTEE FORM AND AMOUNT (NOV 2000)

The offeror shall furnish a separate bid guarantee in accordance with the solicitation provision titled "Bid Guarantee", FAR 52.228-1. In accordance with FAR 28.101-2 the bid guarantee amount shall be at least 20 percent of the "bid price" but shall not exceed \$3 million. When the penal sum is expressed as a percentage, a maximum dollar limitation may be stated. If there are option line items on the Pricing Schedule (Section 00010), the term "bid price" is hereby defined as the total bid not to include any amount for line items designated as "options". In bids/proposals that contain "additives", the "bid price" is defined as the total of all bid items including additive line items. FAR 28.106-1 states that a Standard Form (SF) 24 shall be used for the bid bond. In accordance with FAR 28.202(a)(1), corporate sureties utilized must appear on the list contained in the Department of Treasury Circular 570 titled "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and Acceptable Reinsuring Companies."

52.0236-4507 ACCEPTANCE OF OFFERS (AUG 1991)

A written award or acceptance of an offer, mailed or otherwise furnished to the successful offeror within the time for acceptance specified in the offer, shall result in a binding contract without further action by either party.

52.204-6 DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (JUN 99)

(a) Contractor identification is essential for complying with statutory contract reporting requirements. Therefore, the offeror is requested to enter, in the block with its name and address on the Standard Form 33 or similar document, the annotation "DUNS" followed by the DUNS number which identifies the offeror's name and address exactly as stated in the offer.

(b) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one. A DUNS number will be provided immediately by telephone at no charge to the offeror. For information on obtaining a DUNS number, the offeror, if located within the United States, should call Dun and Bradstreet at 1-800-333-0505. The offeror should be prepared to provide the following information:

- (1) Company name.
- (2) Company address.
- (3) Company telephone number.
- (4) Line of business.
- (5) Chief executive officer/key manager.

(6) Date the company was started.

(7) Number of people employed by the company.

(8) Company affiliation.

(c) Offerors located outside the United States may obtain the location and phone number of the local Dun and Bradstreet Information Services office from the Internet Home Page at <http://www.customerservice@dnb.com/>. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at globalinfo@dnb.com.

(End of provision)

52.211-2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) AND DESCRIPTIONS LISTED IN THE ACQUISITION MANAGEMENT SYSTEMS AND DATA REQUIREMENTS CONTROL LIST, DOD 5010.12-L (DEC 1999)

Copies of specifications, standards, and data item descriptions cited in this solicitation may be obtained--

(a) From the ASSIST database via the Internet at <http://assist.daps.mil>; or

(b) By submitting a request to the--Department of Defense Single Stock Point (DoDSSP), Building 4, Section D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Telephone (215) 697-2667/2179, Facsimile (215) 697-1462.

(End of provision)

52.211-14 NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (SEP 1990)

Any contract awarded as a result of this solicitation will be **DO** rated order certified for national defense use under the Defense Priorities and Allocations System (DPAS) (15 CFR 700), and the Contractor will be required to follow all of the requirements of this regulation. (End of provision)

52.214-1 SOLICITATION DEFINITIONS--SEALED BIDDING (JUL 1987)

"Government" means United States Government.

"Offer" means "bid" in sealed bidding.

"Solicitation" means an invitation for bids in sealed bidding.

(End of provision)

52.214-3 AMENDMENTS TO INVITATIONS FOR BIDS (DEC 1989)

(a) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.

(b) Bidders shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment

number and date in the space provided for this purpose on the form for submitting a bid, (3) by letter or telegram, or (4) by facsimile, if facsimile bids are authorized in the solicitation. The Government must receive the acknowledgment by the time and at the place specified for receipt of bids.

(End of provision)

52.214-4 FALSE STATEMENTS IN BIDS (APR 1984)

Bidders must provide full, accurate, and complete information as required by this solicitation and its attachments. The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

(End of provision)

52.214-5 SUBMISSION OF BIDS (MAR 1997)

(a) Bids and bid modifications shall be submitted in sealed envelopes or packages (unless submitted by electronic means) (1) addressed to the office specified in the solicitation, and (2) showing the time and date specified for receipt, the solicitation number, and the name and address of the bidder.

(b) Bidders using commercial carrier services shall ensure that the bid is addressed and marked on the outermost envelope or wrapper as prescribed in subparagraphs (a)(1) and (2) of this provision when delivered to the office specified in the solicitation.

(c) Telegraphic bids will not be considered unless authorized by the solicitation; however, bids may be modified or withdrawn by written or telegraphic notice.

(d) Facsimile bids, modifications, or withdrawals, will not be considered unless authorized by the solicitation.

(e) Bids submitted by electronic commerce shall be considered only if the electronic commerce method was specifically stipulated or permitted by the solicitation.

52.214-6 EXPLANATION TO PROSPECTIVE BIDDERS (APR 1984)

Any prospective bidder desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing soon enough to allow a reply to reach all prospective bidders before the submission of their bids. Oral explanations or instructions given before the award of a contract will not be binding. Any information given a prospective bidder concerning a solicitation will be furnished promptly to all other prospective bidders as an amendment to the solicitation, if that information is necessary in submitting bids or if the lack of it would be prejudicial to other prospective bidders.

(End of provision)

52.214-7 LATE SUBMISSIONS, MODIFICATIONS, AND WITHDRAWALS OF BIDS (NOV 1999)

(a) Bidders are responsible for submitting bids, and any modifications or withdrawals, so as to reach the Government office designated in the invitation for bids (IFB) by the time specified in the IFB. If no time is specified in the IFB, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that bids are due.

(b)(1) Any bid, modification, or withdrawal received at the Government office designated in the IFB after the exact time specified for receipt of bids is "late" and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late bid would not unduly delay the acquisition; and--

(i) If it was transmitted through an electronic commerce method authorized by the IFB, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of bids; or

(ii) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of bids and was under the Government's control prior to the time set for receipt of bids.

(2) However, a late modification of an otherwise successful bid that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(c) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the bid wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(d) If an emergency or unanticipated event interrupts normal Government processes so that bids cannot be received at the Government office designated for receipt of bids by the exact time specified in the IFB and urgent Government requirements preclude amendment of the IFB, the time specified for receipt of bids will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(e) Bids may be withdrawn by written notice received at any time before the exact time set for receipt of bids. If the IFB authorizes facsimile bids, bids may be withdrawn via facsimile received at any time before the exact time set for receipt of bids, subject to the conditions specified in the provision at 52.214-31, Facsimile Bids. A bid may be withdrawn in person by a bidder or its authorized representative if, before the exact time set for receipt of bids, the identity of the person requesting withdrawal is established and the person signs a receipt for the bid.

(End of provision)

52.214-18 PREPARATION OF BIDS--CONSTRUCTION (APR 1984)

(a) Bids must be (1) submitted on the forms furnished by the Government or on

copies of those forms, and (2) manually signed. The person signing a bid must initial each erasure or change appearing on any bid form.

(b) The bid form may require bidders to submit bid prices for one or more items on various bases, including--

(1) Lump sum bidding;

(2) Alternate prices;

(3) Units of construction; or

(4) Any combination of subparagraphs (1) through (3) above.

(c) If the solicitation requires bidding on all items, failure to do so will disqualify the bid. If bidding on all items is not required, bidders should insert the words "no bid" in the space provided for any item on which no price is submitted.

(d) Alternate bids will not be considered unless this solicitation authorizes their submission.

52.214-19 CONTRACT AWARD--SEALED BIDDING--CONSTRUCTION (AUG 1996)

(a) The Government will evaluate bids in response to this solicitation without discussions and will award a contract to the responsible bidder whose bid, conforming to the solicitation, will be most advantageous to the Government, considering only price and the price-related factors specified elsewhere in the solicitation.

(b) The Government may reject any or all bids, and waive informalities or minor irregularities in bids received.

(c) The Government may accept any item or combination of items, unless doing so is precluded by a restrictive limitation in the solicitation or the bid.

(d) The Government may reject a bid as nonresponsive if the prices bid are materially unbalanced between line items or subline items. A bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated in relation to cost for other work, and if there is a reasonable doubt that the bid will result in the lowest overall cost to the Government even though it may be the low evaluated bid, or if it is so unbalanced as to be tantamount to allowing an advance payment.

52.216-1 TYPE OF CONTRACT (APR 1984)

The Government contemplates award of a firm, fixed-price contract resulting from this solicitation.

(End of clause)

52.217-5 EVALUATION OF OPTIONS (JUL 1990)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

(End of provision)

52.225-10 NOTICE OF BUY AMERICAN ACT/BALANCE OF PAYMENTS PROGRAM
REQUIREMENT--CONSTRUCTION MATERIALS (FEB 2000)

(a) Definitions. Construction material, domestic construction material, and foreign construction material, as used in this provision, are defined in the clause of this solicitation entitled "Buy American Act--Balance of Payments Program--Construction Materials" (Federal Acquisition Regulation (FAR) clause 52.225-9).

(b) Requests for determinations of inapplicability. An offeror requesting a determination regarding the inapplicability of the Buy American Act or Balance of Payments Program should submit the request to the Contracting Officer in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of the clause at FAR 52.225-9 in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act or Balance of Payments Program before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

(c) Evaluation of offers. (1) The Government will evaluate an offer requesting exception to the requirements of the Buy American Act or Balance of Payments Program, based on claimed unreasonable cost of domestic construction material, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(3)(i) of the clause at FAR 52.225-9.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) Alternate offers.

(1) When an offer includes foreign construction material not listed by the Government in this solicitation in paragraph (b)(2) of the clause at FAR 52.225-9, the offeror also may submit an alternate offer based on use of equivalent domestic construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of the clause at FAR 52.225-9 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of the clause at FAR 52.225-9 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic construction material, and the offeror shall be required to furnish such domestic construction material. An offer based on use of the foreign construction material for which an exception was requested--

(i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or

(ii) May be accepted if revised during negotiations.

(End of provision)

52.233-2 SERVICE OF PROTEST (AUG 1996)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from

Contracting Officer
1325 J Street, Rm 878
Sacramento, California 95814

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of provision)

52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995) - ALTERNATE I (FEB 1995)

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) An organized site visit has been scheduled for--

April 24, 2001 at 9:00 a.m.

(c) Participants will meet at--

Beale Air Force Base Main Gate on North Beale Road.

52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate

information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

<http://www.arnet.gov/References/References.html>

52.252-3 ALTERATIONS IN SOLICITATION (APR 1984)

Portions of this solicitation are altered as follows:

N/A

52.252-5 AUTHORIZED DEVIATIONS IN PROVISIONS (APR 1984)

(a) The use in this solicitation of any Federal Acquisition Regulation (48 CFR Chapter 1) provision with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the provision.

(b) The use in this solicitation of any (48 CFR Chapter 2) provision with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

SECTION 00600 Representations & Certifications

CLAUSES INCORPORATED BY FULL TEXT

52.0201.4801

SUBMITTAL INFORMATION (NOV 1993)

Solicitation Number: _____

Offeror's Name, Address, Telephone Number, and Fax Number:

Name of Person to Contact

Telephone Number

Fax Number

Commercial & Government Entity (CAGE) Code, if known:

DUNS Number, if known:

52.203-2 CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985)

(a) The offeror certifies that --

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to (i) those prices, (ii) the intention to submit an offer, or (iii) the methods of factors used to calculate the prices offered:

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory --

(1) Is the person in the offeror's organization responsible for determining the prices offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contradictory to subparagraphs (a)(1) through (a)(3) above; or

(2) (i) Has been authorized, in writing, to act as an agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above _____ (insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization);

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above.

(c) If the offeror deletes or modifies subparagraph (a)(2) above, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of clause)

52.203-11 CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (APR 1991)

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this Certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989,--

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of \$100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision, shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000, for each such failure.

(End of provision)

52.204-3 TAXPAYER IDENTIFICATION (OCT 1998)

(a) Definitions.

Common parent, as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

Taxpayer Identification Number (TIN), as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) Taxpayer Identification Number (TIN).

___ TIN:-----

___ TIN has been applied for.

___ TIN is not required because:

___ Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

___ Offeror is an agency or instrumentality of a foreign government;

___ Offeror is an agency or instrumentality of the Federal Government.

(e) Type of organization.

___ Sole proprietorship;

___ Partnership;

___ Corporate entity (not tax-exempt);

___ Corporate entity (tax-exempt);

___ Government entity (Federal, State, or local);

___ Foreign government;

___ International organization per 26 CFR 1.6049-4;

___ Other-----

(f) Common parent.

___ Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

___ Name and TIN of common parent:

Name-----

TIN-----

(End of provision)

52.204-5 WOMEN-OWNED BUSINESS (OTHER THAN SMALL BUSINESS) (MAY 1999)

(a) Definition. Women-owned business concern, as used in this provision, means a concern that is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of its stock is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(b) Representation. [Complete only if the offeror is a women-owned business concern and has not represented itself as a small business concern in paragraph (b)(1) of FAR 52.219-1, Small Business Program Representations, of this solicitation.] The offeror represents that it () is a women-owned business concern.

(End of provision)

52.209-5 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (JAN 2001)

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that--

(i) The Offeror and/or any of its Principals--

(A) Are [] are not [] presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have [] have not [], within the three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property;

(C) Are [] are not [] presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in subdivision (a)(1)(i)(B) of this provision; and

(ii)(A) The offeror, aside from the offenses enumerated in paragraphs (a)(1)(i)(A), (B), and (C) of this provision, has [] has not [] within the past three years, relative to tax, labor and employment, environmental, antitrust, or consumer protection laws--

(1) Been convicted of a Federal or state felony (or has any Federal or state felony indictments currently pending against them); or

(2) Had a Federal court judgment in a civil case brought by the United States rendered against them; or

(3) Had an adverse decision by a Federal administrative law judge, board, or commission indicating a willful violation of law.

(B) If the offeror has responded affirmatively, the offeror shall provide additional information if requested by the Contracting Officer; and

(iii) The Offeror has ☐ has not ☐, within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER SECTION 1001, TITLE 18, UNITED STATES CODE.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

52.219-1 SMALL BUSINESS PROGRAM REPRESENTATIONS (OCT 2000) ALTERNATE I (OCT 2000) & ALTERNATE II (OCT 2000)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is 23320 .

(2) The small business size standard is \$27,500,000.00.

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) Representations. (1) The offeror represents as part of its offer that it () is, () is not a small business concern.

(2) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, for general statistical purposes, that it () is, () is not a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it () is, () is not a women-owned small business concern.

(4) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it () is, () is not a veteran-owned small business concern.

(5) (Complete only if the offeror represented itself as a veteran-owned small business concern in paragraph (b)(4) of this provision.) The offeror represents as part of its offer that it () is, () is not a service-disabled veteran-owned small business concern.

(6) (Complete only if offeror represented itself as small business concern in paragraph (b)(1) of this provision). The offeror represents, as part of its offer, that--

(i) It () is, () is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR Part 126; and

(ii) It () is, () is not a joint venture that complies with the requirements of 13 CFR Part 126, and the representation in paragraph (b)(6)(i) of this provision is accurate for the HUBZone small business concern or concerns that are participating in the joint venture. (The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture: _____.) Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

(7) (Complete if offeror represented itself as disadvantaged in paragraph (b)(2) of this provision.) The offeror shall check the category in which its ownership falls:

() Black American.

() Hispanic American.

() Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians).

() Asian-Pacific American (persons with origins from Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Japan, China, Taiwan, Laos, Cambodia (Kampuchea), Vietnam, Korea, The Philippines, U.S. Trust Territory of the Pacific Islands (Republic of Palau), Republic of the Marshall Islands, Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Guam, Samoa, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru).

() Subcontinent Asian (Asian-Indian) American (persons with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives Islands, or Nepal).

(c) Definitions. As used in this provision--

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern," means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

Veteran-owned small business concern means a small business concern--

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

"Women-owned small business concern," means a small business concern --

(1) Which is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Notice.

(1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small, HUBZone small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded under the preference programs established pursuant to section 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

(i) Be punished by imposition of fine, imprisonment, or both;

(ii) Be subject to administrative remedies, including suspension and debarment; and

(iii) Be ineligible for participation in programs conducted under the authority of the Act.

(End of provision)

52.219-2 EQUAL LOW BIDS. (OCT 1995)

(a) This provision applies to small business concerns only.

(b) The bidder's status as a labor surplus area (LSA) concern may affect entitlement to award in case of tie bids. If the bidder wishes to be considered for this priority, the bidder must identify, in the following space, the LSA in which the costs to be incurred on account of manufacturing or production (by the bidder or the first-tier subcontractors) amount to more than 50 percent of the contract price.

(c) Failure to identify the labor surplus area as specified in paragraph (b) of this provision will preclude the bidder from receiving priority consideration. If the bidder is awarded a contract as a result of receiving priority

consideration under this provision and would not have otherwise received award, the bidder shall perform the contract or cause the contract to be performed in accordance with the obligations of an LSA concern.

52.222-22 PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (FEB 1999)

The offeror represents that --

(a) ☐ It has, ☐ has not participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation;

(b) ☐ It has, ☐ has not, filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

(End of provision)

52.223-3 HAZARDOUS MATERIAL IDENTIFICATION AND MATERIAL SAFETY DATA (JAN 1997)

(a) "Hazardous material", as used in this clause, includes any material defined as hazardous under the latest version of Federal Standard No. 313 (including revisions adopted during the term of the contract).

(b) The offeror must list any hazardous material, as defined in paragraph (a) of this clause, to be delivered under this contract. The hazardous material shall be properly identified and include any applicable identification number, such as National Stock Number or Special Item Number. This information shall also be included on the Material Safety Data Sheet submitted under this contract.

Material	Identification No.
(If none, insert "None")	
_____	_____
_____	_____
_____	_____

(c) This list must be updated during performance of the contract whenever the Contractor determines that any other material to be delivered under this contract is hazardous.

(d) The apparently successful offeror agrees to submit, for each item as required prior to award, a Material Safety Data Sheet, meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous material identified in paragraph (b) of this clause. Data shall be submitted in accordance with Federal Standard No. 313, whether or not the apparently successful offeror is the actual manufacturer of these items. Failure to submit the Material Safety Data Sheet prior to award may result in the apparently successful offeror being considered nonresponsible and ineligible for award.

(e) If, after award, there is a change in the composition of the item(s) or a revision to Federal Standard No. 313, which renders incomplete or inaccurate the data submitted under paragraph (d) of this clause, the Contractor shall promptly notify the Contracting Officer and resubmit the data.

(f) Neither the requirements of this clause nor any act or failure to act by the Government shall relieve the Contractor of any responsibility or liability for the safety of Government, Contractor, or subcontractor personnel or

property.

(g) Nothing contained in this clause shall relieve the Contractor from complying with applicable Federal, State, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.

(h) The Government's rights in data furnished under this contract with respect to hazardous material are as follows:

(1) To use, duplicate and disclose any data to which this clause is applicable. The purposes of this right are to--

(i) Apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials;

(ii) Obtain medical treatment for those affected by the material; and

(iii) Have others use, duplicate, and disclose the data for the Government for these purposes.

(2) To use, duplicate, and disclose data furnished under this clause, in accordance with subparagraph (h)(1) of this clause, in precedence over any other clause of this contract providing for rights in data.

(3) The Government is not precluded from using similar or identical data acquired from other sources.

(End of clause)

52.223-5 POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION (APR 1998)

(a) Executive Order 12856 of August 3, 1993, requires Federal facilities to comply with the provisions of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA)(42 U.S.C. 11001-11050) and the Pollution Prevention Act of 1990 (PPA)(42 U.S.C. 13101-13109).

(b) The Contractor shall provide all information needed by the Federal facility to comply with the emergency planning reporting requirements of Section 302 of EPCRA; the emergency notice requirements of Section 304 of EPCRA; the list of Material Safety Data Sheets required by Section 311 of EPCRA; the emergency and hazardous chemical inventory forms of Section 312 of EPCRA; the toxic chemical release inventory of Section 313 of EPCRA, which includes the reduction and recycling information required by Section 6607 of PPA; and the toxic chemical reduction goals requirements of Section 3-302 of Executive Order 12856.

52.223-13 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (OCT 2000)

(a) Submission of this certification is a prerequisite for making or entering into this contract imposed by Executive Order 12969, August 8, 1995.

(b) By signing this offer, the offeror certifies that--

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facility is exempt for at least one of the following reasons: (Check each block that is applicable.)

[] (i) The facility does not manufacture, process or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

[] (ii) The facility does not have 10 or more full-time employees as specified in section 313.(b)(1)(A) of EPCRA 42 U.S.C. 11023(b)(1)(A);

[] (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

[] (iv) The facility does not fall within Standard Industrial Classification Code (SIC) major groups 20 through 39 or their corresponding North American Industry Classification System (NAICS) sectors 31 through 33; or

[] (v) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

252.209-7001 DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (MAR 1998)

(a) "Definitions."

As used in this provision --

(a) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405(j)(i)(A)), to be a country the government of which has repeatedly provided support for such acts of international terrorism. As of the date of this provision, terrorist countries include: Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means --

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in "nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtedness of a firm.

(b) "Prohibition on award."

In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary or, in the case of a subsidiary, the firm that owns the subsidiary, unless a waiver is granted by the Secretary of Defense.

(c) "Disclosure."

If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclosure such interest in an attachment to its offer. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include --

- (1) Identification of each government holding a significant interest; and
- (2) A description of the significant interest held by each government.

(End of provision)

252.223-7001 HAZARD WARNING LABELS (DEC 1991)

(a) "Hazardous material," as used in this clause, is defined in the Hazardous Material Identification and Material Safety Data clause of this contract.

(b) The Contractor shall label the item package (unit container) of any hazardous material to be delivered under this contract in accordance with the Hazard Communication Standard (29 CFR 1910.1200 et seq). The Standard requires that the hazard warning label conform to the requirements of the standard unless the material is otherwise subject to the labeling requirements of one of the following statutes:

- (1) Federal Insecticide, Fungicide and Rodenticide Act;
- (2) Federal Food, Drug and Cosmetics Act;
- (3) Consumer Product Safety Act;
- (4) Federal Hazardous Substances Act; or
- (5) Federal Alcohol Administration Act.

(c) The Offeror shall list which hazardous material listed in the Hazardous Material Identification and Material Safety Data clause of this contract will be labeled in accordance with one of the Acts in paragraphs (b)(1) through (5) of this clause instead of the Hazard Communication Standard. Any hazardous material not listed will be interpreted to mean that a label is required in accordance with the Hazard Communication Standard.

MATERIAL (If None, Insert "None.")

ACT

(d) The apparently successful Offeror agrees to submit, before award, a copy of the hazard warning label for all hazardous materials not listed in paragraph (c) of this clause. The Offeror shall submit the label with the Material Safety Data Sheet being furnished under the Hazardous Material Identification and Material Safety Data clause of this contract.

(e) The Contractor shall also comply with MIL-STD-129, Marking for Shipment and Storage (including revisions adopted during the term of this contract).

(End of clause)

252.247-7022 REPRESENTATION OF EXTENT OF TRANSPORTATION BY SEA (AUG 1992)

(a) The Offeror shall indicate by checking the appropriate blank in paragraph (b) of this provision whether transportation of supplies by sea is anticipated under the resultant contract. The term supplies is defined in the

Transportation of Supplies by Sea clause of this solicitation.

(b) Representation. The Offeror represents that it:

____ (1) Does anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

____ (2) Does not anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

(c) Any contract resulting from this solicitation will include the Transportation of Supplies by Sea clause. If the Offeror represents that it will not use ocean transportation, the resulting contract will also include the Defense FAR Supplement clause at 252.247-7024, Notification of Transportation of Supplies by Sea.

(End of provision)

SECTION 00700 Contract Clauses

CLAUSES INCORPORATED BY FULL TEXT

52.202-1 DEFINITIONS (OCT 1995) --ALTERNATE I (APR 1984)

(a) "Head of the agency" (also called "agency head") or "Secretary" means the Secretary (or Attorney General, Administrator, Governor, Chairperson, or other chief official, as appropriate) of the agency, including any deputy or assistant chief official of the agency; and the term "authorized representative" means any person, persons, or board (other than the Contracting Officer) authorized to act for the head of the agency or Secretary.

(b) "Commercial component" means any component that is a commercial item.

(c) "Component" means any item supplied to the Federal Government as part of an end item or of another component.

(d) "Nondevelopmental item" means--

(1) Any previously developed item of supply used exclusively for governmental purposes by a Federal agency, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement;

(2) Any item described in paragraph (e)(1) of this definition that requires only minor modification or modifications of a type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency; or

(3) Any item of supply being produced that does not meet the requirements of paragraph (e)(1) or (e)(2) solely because the item is not yet in use.

(e) "Contracting Officer" means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(f) Except as otherwise provided in this contract, the term "subcontracts" includes, but is not limited to, purchase orders and changes and modifications to purchase orders under this contract.

52.203-3 GRATUITIES (APR 1984)

(a) The right of the Contractor to proceed may be terminated by written notice if, after notice and hearing, the agency head or a designee determines that the Contractor, its agent, or another representative--

(1) Offered or gave a gratuity (e.g., an entertainment or gift) to an officer, official, or employee of the Government; and

(2) Intended, by the gratuity, to obtain a contract or favorable treatment under a contract.

(b) The facts supporting this determination may be reviewed by any court having lawful jurisdiction.

(c) If this contract is terminated under paragraph (a) of this clause, the Government is entitled--

(1) To pursue the same remedies as in a breach of the contract; and

(2) In addition to any other damages provided by law, to exemplary damages of not less than 3 nor more than 10 times the cost incurred by the Contractor in giving gratuities to the person concerned, as determined by the agency head or a designee. (This subparagraph (c)(2) is applicable only if this contract uses money appropriated to the Department of Defense.)

(d) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.203-5 COVENANT AGAINST CONTINGENT FEES (APR 1984)

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a contractor and subject to the contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract on any basis other than the merits of the matter.

(End of clause)

52.203-6 RESTRICTIONS ON SUBCONTRACTOR SALES TO THE GOVERNMENT (JUL 1995)

(a) Except as provided in (b) of this clause, the Contractor shall not enter into any agreement with an actual or prospective subcontractor, nor otherwise act in any manner, which has or may have the effect of restricting sales by such subcontractors directly to the Government of any item or process (including computer software) made or furnished by the subcontractor under this contract or under any follow-on production contract.

(b) The prohibition in (a) of this clause does not preclude the Contractor from asserting rights that are otherwise authorized by law or regulation.

(c) The Contractor agrees to incorporate the substance of this clause, including this paragraph (c), in all subcontracts under this contract which exceed \$100,000.

52.203-7 ANTI-KICKBACK PROCEDURES. (JUL 1995)

(a) Definitions.

"Kickback," as used in this clause, means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided, directly or indirectly, to any prime Contractor, prime Contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a subcontract relating to a prime contract.

"Person," as used in this clause, means a corporation, partnership, business association of any kind, trust, joint-stock company, or individual.

"Prime contract," as used in this clause, means a contract or contractual action entered into by the United States for the purpose of obtaining supplies, materials, equipment, or services of any kind.

"Prime Contractor," as used in this clause, means a person who has entered into a prime contract with the United States.

"Prime Contractor employee," as used in this clause, means any officer, partner, employee, or agent of a prime Contractor.

"Subcontract," as used in this clause, means a contract or contractual action entered into by a prime Contractor or subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind under a prime contract.

"Subcontractor," as used in this clause, (1) means any person, other than the prime Contractor, who offers to furnish or furnishes any supplies, materials, equipment, or services of any kind under a prime contract or a subcontract entered into in connection with such prime contract, and (2) includes any person who offers to furnish or furnishes general supplies to the prime Contractor or a higher tier subcontractor.

"Subcontractor employee," as used in this clause, means any officer, partner, employee, or agent of a subcontractor.

(b) The Anti-Kickback Act of 1986 (41 U.S.C. 51-58) (the Act), prohibits any person from -

(1) Providing or attempting to provide or offering to provide any kickback;

(2) Soliciting, accepting, or attempting to accept any kickback; or

(3) Including, directly or indirectly, the amount of any kickback in the contract price charged by a prime Contractor to the United States or in the contract price charged by a subcontractor to a prime Contractor or higher tier subcontractor.

(c)(1) The Contractor shall have in place and follow reasonable procedures designed to prevent and detect possible violations described in paragraph (b) of this clause in its own operations and direct business relationships.

(2) When the Contractor has reasonable grounds to believe that a violation described in paragraph (b) of this clause may have occurred, the Contractor shall promptly report in writing the possible violation. Such reports shall be made to the inspector general of the contracting agency, the head of the contracting agency if the agency does not have an inspector general, or the Department of Justice.

(3) The Contractor shall cooperate fully with any Federal agency investigating a possible violation described in paragraph (b) of this clause.

(4) The Contracting Officer may (i) offset the amount of the kickback against any monies owed by the United States under the prime contract and/or (ii) direct that the Prime Contractor withhold, from sums owed a subcontractor

under the prime contract, the amount of any kickback. The Contracting Officer may order the monies withheld under subdivision (c)(4)(ii) of this clause be paid over to the Government unless the Government has already offset those monies under subdivision (c)(4)(i) of this clause. In either case, the Prime Contractor shall notify the Contracting Officer when the monies are withheld.

(5) The Contractor agrees to incorporate the substance of this clause, including this subparagraph (c)(5) but excepting subparagraph (c)(1), in all subcontracts under this contract which exceed \$100,000.

52.203-8 CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)

(a) If the Government receives information that a contractor or a person has engaged in conduct constituting a violation of subsection (a), (b), (c), or (d) of Section 27 of the Office of Federal Procurement Policy Act (41 U.S.C. 423) (the Act), as amended by section 4304 of the 1996 National Defense Authorization Act for Fiscal Year 1996 (Pub. L. 104-106), the Government may--

(1) Cancel the solicitation, if the contract has not yet been awarded or issued; or

(2) Rescind the contract with respect to which--

(i) The Contractor or someone acting for the Contractor has been convicted for an offense where the conduct constitutes a violation of subsection 27 (a) or (b) of the Act for the purpose of either--

(A) Exchanging the information covered by such subsections for anything of value; or

(B) Obtaining or giving anyone a competitive advantage in the award of a Federal agency procurement contract; or

(ii) The head of the contracting activity has determined, based upon a preponderance of the evidence, that the Contractor or someone acting for the Contractor has engaged in conduct constituting an offense punishable under subsections 27(e)(1) of the Act.

(b) If the Government rescinds the contract under paragraph (a) of this clause, the Government is entitled to recover, in addition to any penalty prescribed by law, the amount expended under the contract.

(c) The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law, regulation, or under this contract.

52.203-10 PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)

(a) The Government, at its election, may reduce the price of a fixed-price type contract and the total cost and fee under a cost-type contract by the amount of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or designee determines that there was a violation of subsection 27 (a), (b), or (c) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in section 3.104 of the Federal Acquisition Regulation.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be--

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award,

notwithstanding any minimum fee or "fee floor" specified in the contract;

(3) For cost-plus-award-fee contracts--

(i) The base fee established in the contract at the time of contract award;

(ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may--

(i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or

(ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract. The total final price established in accordance with the incentive price revision provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed-price contracts, by 10 percent of the initial contract price or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.

(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.203-12 LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (JUN 1997)

(a) Definitions.

"Agency," as used in this clause, means executive agency as defined in 2.101.

"Covered Federal action," as used in this clause, means any of the following Federal actions:

(1) The awarding of any Federal contract.

(2) The making of any Federal grant.

(3) The making of any Federal loan.

(4) The entering into of any cooperative agreement.

(5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

- (1) An individual who is appointed to a position in the Government under title 5, United States Code, including a position under a temporary appointment.
- (2) A member of the uniformed services, as defined in subsection 101(3), title 37, United States Code.
- (3) A special Government employee, as defined in section 202, title 18, United States Code.
- (4) An individual who is a member of a Federal advisory committee, as defined by the Federal Advisory Committee Act, title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual, corporation, company, association, authority, firm, partnership, society, State, and local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means, with respect to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Regularly employed," as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

"State," as used in this clause, means a State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, a territory or possession of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) Prohibitions.

(1) Section 1352 of title 31, United States Code, among other things, prohibits a recipient of a Federal contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) Agency and legislative liaison by own employees.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b)(3)(i)(A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person's products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person's products or services for an agency's use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action--

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b)(3)(i)(A) of this clause are permitted under this clause.

(ii) Professional and technical services.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of--

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal

action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

(2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.

(B) For purposes of subdivision (b)(3)(ii)(A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance or operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis is rendered directly and solely in the preparation, submission or negotiation of a covered Federal action. Thus, for example, communications with the intent to influence made by a lawyer that do not provide legal advice or analysis directly and solely related to the legal aspects of his or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.

(C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.

(D) Only those services expressly authorized by subdivisions (b)(3)(ii)(A)(1) and (2) of this clause are permitted under this clause.

(E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(c) Disclosure.

(1) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b)(1) of this clause, if paid for with appropriated funds.

(2) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c)(1) of this clause. An event that materially affects the accuracy of the information reported includes--

(i) A cumulative increase of \$25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or

(ii) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(iii) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

(3) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or receives any subcontract exceeding \$100,000 under the Federal contract.

(4) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontract file of the awarding Contractor.

(d) Agreement. The Contractor agrees not to make any payment prohibited by this clause.

(e) Penalties.

(1) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(2) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(f) Cost allowability. Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely, costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

(End of clause)

52.204-4 PRINTING/COPYING DOUBLE-SIDED ON RECYCLED PAPER (AUG 2000)

(a) Definitions. As used in this clause--

Postconsumer material means a material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item. Postconsumer material is a part of the broader category of "recovered material." For paper and paper products, postconsumer material means "postconsumer fiber" defined by the U.S. Environmental Protection Agency (EPA) as--

(1) Paper, paperboard, and fibrous materials from retail stores, office buildings, homes, and so forth, after they have passed through their end-usage as a consumer item, including: used corrugated boxes; old newspapers; old magazines; mixed waste paper; tabulating cards; and used cordage; or

(2) All paper, paperboard, and fibrous materials that enter and are collected from municipal solid waste; but not

(3) Fiber derived from printers' over-runs, converters' scrap, and over-issue publications.

Printed or copied double-sided means printing or reproducing a document so that information is on both sides of a sheet of paper.

Recovered material, for paper and paper products, is defined by EPA in its Comprehensive Procurement Guideline as "recovered fiber" and means the following materials:

(1) Postconsumer fiber; and

(2) Manufacturing wastes such as--

(i) Dry paper and paperboard waste generated after completion of the papermaking process (that is, those manufacturing operations up to and including the cutting and trimming of the paper machine reel into smaller rolls or rough sheets) including: envelope cuttings, bindery trimmings, and other paper and paperboard waste resulting from printing, cutting, forming, and other converting operations; bag, box, and carton manufacturing wastes; and butt rolls, mill wrappers, and rejected unused stock; and

(ii) Repulped finished paper and paperboard from obsolete inventories of paper and paperboard manufacturers, merchants, wholesalers, dealers, printers, converters, or others.

(b) In accordance with Section 101 of Executive Order 13101 of September 14, 1998, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition, the Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed or copied double-sided on recycled paper that meet minimum content standards specified in Section 505 of Executive Order 13101, when not using electronic commerce methods to submit information or data to the Government.

(c) If the Contractor cannot purchase high-speed copier paper, offset paper, forms bond, computer printout paper, carbonless paper, file folders, white wove envelopes, writing and office paper, book paper, cotton fiber paper, and cover stock meeting the 30 percent postconsumer material standard for use in submitting paper documents to the Government, it should use paper containing no less than 20 percent postconsumer material. This lesser standard should be used only when paper meeting the 30 percent postconsumer material standard is not obtainable at a reasonable price or does not meet reasonable performance standards.

(End of clause)

52.209-6 PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT (JUL 1995)

(a) The Government suspends or debar Contractors to protect the Government's interests. The Contractor shall not enter into any subcontract in excess of the \$25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed \$25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principles, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs). The notice must include the following:

(1) The name of the subcontractor.

(2) The Contractor's knowledge of the reasons for the subcontractor being on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(3) The compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interests when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

(End of clause)

52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within **10** calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than **350** calendar days after notice to proceed. The time stated for completion shall include final cleanup of the premises.

(End of clause)

52.211-12 LIQUIDATED DAMAGES--CONSTRUCTION (SEP 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of **\$1,355.00** for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

(End of clause)

52.211-15 DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (SEP 1990)

This is a rated order certified for national defense use, and the Contractor shall follow all the requirements of the Defense Priorities and Allocations System regulation (15 CFR 700).

(End of clause)

52.214-26 AUDIT AND RECORDS--SEALED BIDDING. (OCT 1997)

(a) As used in this clause, records includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) Cost or pricing data. If the Contractor has been required to submit cost or pricing data in connection with the pricing of any modification to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections, related to--

(1) The proposal for the modification;

(2) The discussions conducted on the proposal(s), including those related to negotiating;

(3) Pricing of the modification; or

(4) Performance of the modification.

(c) Comptroller General. In the case of pricing any modification, the Comptroller General of the United States, or an authorized representative, shall have the same rights as specified in paragraph (b) of this clause.

(d) Availability. The Contractor shall make available at its office at all reasonable times the materials described in reproduction, until 3 years after final payment under this contract, or for any other period specified in Subpart 4.7 of

the Federal Acquisition Regulation (FAR). FAR Subpart 4.7, Contractor Records Retention, in effect on the date of this contract, is incorporated by reference in its entirety and made a part of this contract.

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement.

(2) Records pertaining to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to the performance of this contract shall be made available until disposition of such appeals, litigation, or claims.

(e) The Contractor shall insert a clause containing all the provisions of this clause, including this paragraph (e), in all subcontracts expected to exceed the threshold in FAR 15.403-4(a)(1) for submission of cost or pricing data.

52.214-27 PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA - MODIFICATIONS - SEALED BIDDING. (OCT 1997)

(a) This clause shall become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for the submission of cost or pricing data at FAR 15.403-4(a)(1), except that this clause does not apply to a modification if an exception under FAR 15.403-1(b) applies.

(1) Based on adequate price competition;

(2) Based on established catalog or market prices of commercial items sold in substantial quantities to the general public; or

(3) Set by law or regulation.

(b) If any price, including profit, negotiated in connection with any modification under this clause, was increased by any significant amount because

(1) the Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data;

(2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data; or

(3) any of these parties furnished data of any description that were not accurate, the price shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) above.

(c) Any reduction in the contract price under paragraph (b) above due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which:

(1) the actual subcontract; or

(2) the actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(d) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made:

(1) the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted;

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer;

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract; or

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2) Except as prohibited by subdivision (d)(2)(ii) of this clause:

(i) an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if:

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the date of agreement on the price of the contract (or price of the modification) and that the data were not submitted before such date.

(ii) An offset shall not be allowed if:

(A) The understated data was known by the Contractor to be understated when the Certificate of Current Cost or Pricing Data was signed; or (B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data had been submitted before the date of agreement on price.

(e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid:

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and

(2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

52.214-28 SUBCONTRACTOR COST OR PRICING DATA - MODIFICATIONS - SEALED BIDDING. (OCT 1997)

(a) The requirements of paragraphs (b) and (c) of this clause shall:

(1) become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at (FAR) 48 CFR 15.403-4(a)(1); and

(2) be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modifications involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.403-1(b) applies.

(1) Based on adequate price competition;

(2) Based on established catalog or market prices of commercial items sold in substantial quantities to the general public; or

(3) Set by law or regulation.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in subsection 15.406-2 of the Federal Acquisition Regulation that, to the best of its knowledge and belief, the data submitted under paragraph (b) above were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(d) The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that, when entered into, exceeds the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1).

52.214-29 ORDER OF PRECEDENCE--SEALED BIDDING (JAN 1986)

Any inconsistency in this solicitation or contract shall be resolved by giving precedence in the following order: (a) the Schedule (excluding the specifications); (b) representations and other instructions; (c) contract clauses; (d) other documents, exhibits, and attachments; and (e) the specifications.

(End of clause)

52.219-8 UTILIZATION OF SMALL BUSINESS CONCERNS (OCT 2000)

(a) It is the policy of the United States that small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns shall have the maximum practicable opportunity to participate in performing contracts let by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its prime contractors establish procedures to ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns.

(b) The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. The Contractor further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of the Contractor's compliance with this clause.

Definitions. As used in this contract--

HUBZone small business concern means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

Small business concern means a small business as defined pursuant to Section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto.

Small disadvantaged business concern means a small business concern that represents, as part of its offer that--

(1) It has received certification as a small disadvantaged business concern consistent with 13 CFR part 124, subpart B;

(2) No material change in disadvantaged ownership and control has occurred since its certification;

(3) Where the concern is owned by one or more individuals, the net worth of each individual upon whom the certification is based does not exceed \$750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); and

(4) It is identified, on the date of its representation, as a certified small disadvantaged business in the database maintained by the Small Business Administration (PRO-Net).

Veteran-owned small business concern means a small business concern--

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

Women-owned small business concern means a small business concern--

(1) That is at least 51 percent owned by one or more women, or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern, a veteran-owned small business concern, a service-disabled veteran-owned small business concern, a HUBZone small business concern, a small disadvantaged business concern, or a women-owned small business concern.

(End of clause)

52.219-14 LIMITATIONS ON SUBCONTRACTING (DEC 1996)

- (a) This clause does not apply to the unrestricted portion of a partial set-aside.
- (b) By submission of an offer and execution of a contract, the Offeror/Contractor agrees that in performance of the contract in the case of a contract for--
 - (1) Services (except construction). At least 50 percent of the cost of contract performance incurred for personnel shall be expended for employees of the concern.
 - (2) Supplies (other than procurement from a nonmanufacturer of such supplies). The concern shall perform work for at least 50 percent of the cost of manufacturing the supplies, not including the cost of materials.
 - (3) General construction. The concern will perform at least 15 percent of the cost of the contract, not including the cost of materials, with its own employees.
 - (4) Construction by special trade contractors. The concern will perform at least 25 percent of the cost of the contract, not including the cost of materials, with its own employees.

52.219-18 NOTIFICATION OF COMPETITION LIMITED TO ELIGIBLE 8(A) CONCERNS (JUN 1999)-- ALTERNATE I (NOV 1989)

- (a) Offers are solicited only from small business concerns expressly certified by the Small Business Administration (SBA) for participation in the SBA's 8(a) Program and which meet the following criteria at the time of submission of offer--
 - (1) The Offeror is in conformance with the 8(a) support limitation set forth in its approved business plan; and
 - (3) The Offeror is in conformance with the Business Activity Targets set forth in its approved business plan or any remedial action directed by the SBA.
 - (4) The offeror's approved business plan is on the file and serviced by **The Small Business Administration Office San Francisco District Office.**
- (b) By submission of its offer, the Offeror certifies that it meets all of the criteria set forth in paragraph (a) of this clause.
- (c) (DFARS 252.219-7010 ALTERNATE A (JUN 1998)) Any award resulting from this solicitation will be made directly by the Contracting Officer to the successful 8(a) offeror selected through the evaluation criteria set forth in this solicitation.
- (d)(1) Agreement. A manufacturer or regular dealer submitting an offer in its own name agrees to furnish, in performing the contract, only end items manufactured or produced by small business concerns inside the United States, its territories or possessions, the Commonwealth of Puerto Rico, or the Trust Territory of the Pacific Islands. However, this requirement does not apply in connection with construction or service contracts.
- (2) The **[insert name of SBA's contractor]** will notify the **[insert name of contracting agency]** Contracting Officer in writing immediately upon entering an agreement (either oral or written) to transfer all or part of its stock or other ownership interest to any other party.

(End of clause)

52.222-3 CONVICT LABOR (AUG 1996)

The Contractor agrees not to employ in the performance of this contract any person undergoing a sentence of imprisonment which has been imposed by any court of a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands. This limitation, however, shall not prohibit the employment by the Contractor in the performance of this contract of persons on parole or probation to work at paid employment during the term of their sentence or persons who have been pardoned or who have served their terms. Nor shall it prohibit the employment by the Contractor in the performance of this contract of persons confined for violation of the laws of any of the States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands who are authorized to work at paid employment in the community under the laws of such jurisdiction, if--

- (a)(1) The worker is paid or is in an approved work training program on a voluntary basis;
- (2) Representatives of local union central bodies or similar labor union organizations have been consulted;
- (3) Such paid employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services; and
- (4) The rates of pay and other conditions of employment will not be less than those paid or provided for work of a similar nature in the locality in which the work is being performed; and
- (b) The Attorney General of the United States has certified that the work-release laws or regulations of the jurisdiction involved are in conformity with the requirements of Executive Order 11755, as amended by Executive Orders 12608 and 12943.

(End of clause)

52.222-4 CONTRACT WORK HOURS AND SAFETY STANDARDS ACT - OVERTIME COMPENSATION. (SEP 2000)

- (a) Overtime requirements. No Contractor or subcontractor employing laborers or mechanics (see Federal Acquisition Regulation 22.300) shall require or permit them to work over 40 hours in any workweek unless they are paid at least 1 and 1/2 times the basic rate of pay for each hour worked over 40 hours.
- (b) Violation; liability for unpaid wages; liquidated damages. The responsible Contractor and subcontractor are liable for unpaid wages if they violate the terms in paragraph (a) of this clause. In addition, the Contractor and subcontractor are liable for liquidated damages payable to the Government. The Contracting Officer will assess liquidated damages at the rate of \$10 per affected employee for each calendar day on which the employer required or permitted the employee to work in excess of the standard workweek of 40 hours without paying overtime wages required by the Contract Work Hours and Safety Standards Act.
- (c) Withholding for unpaid wages and liquidated damages. The Contracting Officer will withhold from payments due under the contract sufficient funds required to satisfy any Contractor or subcontractor liabilities for unpaid wages and liquidated damages. If amounts withheld under the contract are insufficient to satisfy Contractor or subcontractor liabilities, the Contracting Officer will withhold payments from other Federal or Federally assisted contracts held by the same Contractor that are subject to the Contract Work Hours and Safety Standards Act.
- (d) Payrolls and basic records.

(1) The Contractor and its subcontractors shall maintain payrolls and basic payroll records for all laborers and mechanics working on the contract during the contract and shall make them available to the Government until 3 years after contract completion. The records shall contain the name and address of each employee, social security number, labor classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. The records need not duplicate those required for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act.

(2) The Contractor and its subcontractors shall allow authorized representatives of the Contracting Officer or the Department of Labor to inspect, copy, or transcribe records maintained under paragraph (d)(1) of this clause. The Contractor or subcontractor also shall allow authorized representatives of the Contracting Officer or Department of Labor to interview employees in the workplace during working hours.

(e) Subcontracts. The Contractor shall insert the provisions set forth in paragraphs (a) through (d) of this clause in subcontracts exceeding \$100,000 and require subcontractors to include these provisions in any lower tier subcontracts. The Contractor shall be responsible for compliance by any subcontractor or lower-tier subcontractor with the provisions set forth in paragraphs (a) through (d) of this clause.

(End of clause)

52.222-6 DAVIS-BACON ACT (FEB 1995)

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b)(1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approve an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(d) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

52.222-7 WITHHOLDING OF FUNDS (FEB 1988)

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

52.222-8 PAYROLLS AND BASIC RECORDS (FEB 1988)

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in

section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify--

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

52.222-9 APPRENTICES AND TRAINEES (FEB 1988)

(a) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not

individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

52.222-10 COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988)

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

52.222-11 SUBCONTRACTS (LABOR STANDARDS (FEB 1988)

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act-Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination-Debarment, Disputes Concerning Labor Standards, Compliance with Davis-Bacon and Related Act Regulations, and Certification of Eligibility, and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b)(1) Within 14 days after award of the contract, the Contractor shall deliver to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(2) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall deliver to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

52.222-12 CONTRACT TERMINATION--DEBARMENT (FEB 1988)

A breach of the contract clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

52.222-13 COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988)

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this contract.

52.222-14 DISPUTES CONCERNING LABOR STANDARDS (FEB 1988)

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

52.222-15 CERTIFICATION OF ELIGIBILITY (FEB 1988)

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

52.222-21 PROHIBITION OF SEGREGATED FACILITIES (FEB 1999)

(a) Segregated facilities, as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(b) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Opportunity clause of this contract.

(End of clause)

52.222-23 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
14.3%	6.9%

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours

performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, within 10 working days following award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the --

- (1) Name, address, and telephone number of the subcontractor;
- (2) Employer's identification number of the subcontractor;
- (3) Estimated dollar amount of the subcontract;
- (4) Estimated starting and completion dates of the subcontract; and
- (5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is **Butte, Colusa, El Dorado, Nevada, Glenn, Sierra, Sutter, and Yuba Counties, California.**

52.222-26 EQUAL OPPORTUNITY (FEB 1999)

(a) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of \$10,000, the Contractor shall comply with subparagraphs (b)(1) through (11) of this clause. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.

(b) During performing this contract, the Contractor agrees as follows:

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. However, it shall not be a violation of this clause for the Contractor to extend a publicly announced preference in employment to Indians living on or near an Indian reservation, in connection with employment opportunities on or near an Indian reservation, as permitted by 41 CFR 60-1.5.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (i) employment, (ii) upgrading, (iii) demotion, (iv) transfer, (v) recruitment or recruitment advertising, (vi) layoff or termination, (vii) rates of pay or other forms of compensation, and (viii) selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race,

color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. The Contractor shall also file Standard Form 100 (EEO-1), or any successor form, as prescribed in 41 CFR part 60-1. Unless the Contractor has filed within the 12 months preceding the date of contract award, the Contractor shall, within 30 days after contract award, apply to either the regional Office of Federal Contract Compliance Programs (OFCCP) or the local office of the Equal Employment Opportunity Commission for the necessary forms.

(8) The Contractor shall permit access to its premises, during normal business hours, by the contracting agency or the OFCCP for the purpose of conducting on-site compliance evaluations and complaint investigations. The Contractor shall permit the Government to inspect and copy any books, accounts, records (including computerized records), and other material that may be relevant to the matter under investigation and pertinent to compliance with Executive Order 11246, as amended, and rules and regulations that implement the Executive Order.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended; in the rules, regulations, and orders of the Secretary of Labor; or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of subparagraphs (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the contracting officer may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to

this clause will be governed by the procedures in 41 CFR 60-1.1.

52.222-27 AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION
(FEB 1999)

(a) Definitions. "Covered area," as used in this clause, means the geographical area described in the solicitation for this contract.

"Deputy Assistant Secretary," as used in this clause, means Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, or a designee.

"Employer's identification number," as used in this clause, means the Federal Social Security number used on the employer's quarterly federal tax return, U.S. Treasury Department Form 941.

"Minority," as used in this clause, means--

(1) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands);

(3) Black (all persons having origins in any of the black African racial groups not of Hispanic origin); and

(4) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race).

(b) If the Contractor, or a subcontractor at any tier, subcontracts a portion of the work involving any construction trade, each such subcontract in excess of \$10,000 shall include this clause and the Notice containing the goals for minority and female participation stated in the solicitation for this contract.

(c) If the Contractor is participating in a Hometown Plan (41 CFR 60-4) approved by the U.S. Department of Labor in a covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals) shall comply with the plan for those trades that have unions participating in the plan. Contractors must be able to demonstrate participation in, and compliance with, the provisions of the plan. Each Contractor or subcontractor participating in an approved plan is also required to comply with its obligations under the Equal Opportunity clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good-faith performance by other Contractors or subcontractors toward a goal in an approved plan does not excuse any Contractor's or subcontractor's failure to make good-faith efforts to achieve the plan's goals.

(d) The Contractor shall implement the affirmative action procedures in subparagraphs (g)(1) through (16) of this clause. The goals stated in the

solicitation for this contract are expressed as percentages of the total hours of employment and training of minority and female utilization that the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where that work is actually performed. The Contractor is expected to make substantially uniform progress toward its goals in each craft.

(e) Neither the terms and conditions of any collective bargaining agreement, nor the failure by a union with which the Contractor has a collective bargaining agreement, to refer minorities or women shall excuse the Contractor's obligations under this clause, Executive Order 11246, as amended, or the regulations thereunder.

(f) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(g) The Contractor shall take affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with this clause shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and implement affirmative action steps at least as extensive as the following:

(1) Ensure a working environment free of harassment, intimidation, and coercion at all sites and in all facilities where the Contractor's employees are assigned to work. The Contractor, if possible, will assign two or more women to each construction project. The Contractor shall ensure that foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at these sites or facilities.

(2) Establish and maintain a current list of sources for minority and female recruitment. Provide written notification to minority and female recruitment sources and community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

(3) Establish and maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant, referrals of minorities or females from unions, recruitment sources, or community organizations, and the action taken with respect to each individual. If an individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred back, not employed by the Contractor, this shall be documented in the file, along with whatever additional actions the Contractor may have taken.

(4) Immediately notify the Deputy Assistant Secretary when the union or unions with which the Contractor has a collective bargaining agreement has

not referred back to the Contractor a minority or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(5) Develop on-the-job training opportunities and/or participate in training programs for the area that expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under subparagraph (g)(2) of this clause.

(6) Disseminate the Contractor's equal employment policy by--

(i) Providing notice of the policy to unions and to training, recruitment, and outreach programs, and requesting their cooperation in assisting the Contractor in meeting its contract obligations;

(ii) Including the policy in any policy manual and in collective bargaining agreements;

(iii) Publicizing the policy in the company newspaper, annual report, etc.;

(iv) Reviewing the policy with all management personnel and with all minority and female employees at least once a year; and

(v) Posting the policy on bulletin boards accessible to employees at each location where construction work is performed.

(7) Review, at least annually, the Contractor's equal employment policy and affirmative action obligations with all employees having responsibility for hiring, assignment, layoff, termination, or other employment decisions. Conduct review of this policy with all on-site supervisory personnel before initiating construction work at a job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

(8) Disseminate the Contractor's equal employment policy externally by including it in any advertising in the news media, specifically including minority and female news media. Provide written notification to, and discuss this policy with, other Contractors and subcontractors with which the Contractor does or anticipates doing business.

(9) Direct recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month before the date for acceptance of applications for apprenticeship or training by any recruitment source, send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

(10) Encourage present minority and female employees to recruit minority persons and women. Where reasonable, provide after-school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.

(11) Validate all tests and other selection requirements where required under 41 CFR 60-3.

(12) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for, through appropriate training, etc., opportunities for promotion.

(13) Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the Contractor's obligations under this contract are being carried out.

(14) Ensure that all facilities and company activities are nonsegregated except that separate or single-user rest rooms and necessary dressing or sleeping areas shall be provided to assure privacy between the sexes.

(15) Maintain a record of solicitations for subcontracts for minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

(16) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's equal employment policy and affirmative action obligations.

(h) The Contractor is encouraged to participate in voluntary associations that may assist in fulfilling one or more of the affirmative action obligations contained in subparagraphs (g)(1) through (16) of this clause. The efforts of a contractor association, joint contractor-union, contractor-community, or similar group of which the contractor is a member and participant may be asserted as fulfilling one or more of its obligations under subparagraphs (g)(1) through (16) of this clause, provided the Contractor--

(1) Actively participates in the group;

(2) Makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry;

(3) Ensures that concrete benefits of the program are reflected in the Contractor's minority and female workforce participation;

(4) Makes a good-faith effort to meet its individual goals and timetables; and

(5) Can provide access to documentation that demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply is the Contractor's, and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(i) A single goal for minorities and a separate single goal for women shall be established. The Contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male

and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of Executive Order 11246, as amended, if a particular group is employed in a substantially disparate manner.

(j) The Contractor shall not use goals or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

(k) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts under Executive Order 11246, as amended.

(l) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the Equal Opportunity clause, including suspension, termination, and cancellation of existing subcontracts, as may be imposed or ordered under Executive Order 11246, as amended, and its implementing regulations, by the OFCCP. Any failure to carry out these sanctions and penalties as ordered shall be a violation of this clause and Executive Order 11246, as amended.

(m) The Contractor in fulfilling its obligations under this clause shall implement affirmative action procedures at least as extensive as those prescribed in paragraph (g) of this clause, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of Executive Order 11246, as amended, the implementing regulations, or this clause, the Deputy Assistant Secretary shall take action as prescribed in 41 CFR 60-4.8.

(n) The Contractor shall designate a responsible official to--

(1) Monitor all employment-related activity to ensure that the Contractor's equal employment policy is being carried out;

(2) Submit reports as may be required by the Government; and

(3) Keep records that shall at least include for each employee the name, address, telephone number, construction trade, union affiliation (if any), employee identification number, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, separate records are not required to be maintained.

Nothing contained herein shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

52.222-35 AFFIRMATIVE ACTION FOR DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA (APR 1998)

(a)) Definitions. As used in this clause--

All employment openings includes all positions except executive and top management, those positions that will be filled from within the contractor's organization, and positions lasting 3 days or less. This term includes full-time employment, temporary employment of more than 3 days' duration, and part-time employment.

Appropriate office of the State employment service system means the local office of the Federal-State national system of public employment offices with assigned responsibility to serve the area where the employment opening is to be filled, including the District of Columbia, Guam, the Commonwealth of Puerto Rico, and the Virgin Islands.

Positions that will be filled from within the Contractor's organization means employment openings for which no consideration will be given to persons outside the Contractor's organization (including any affiliates, subsidiaries, and parent companies) and includes any openings that the Contractor proposes to fill from regularly established "recall" lists. The exception does not apply to a particular opening once an employer decides to consider applicants outside of its organization.

Veteran of the Vietnam era means a person who--

(1) Served on active duty for a period of more than 180 days, any part of which occurred between August 5, 1964, and May 7, 1975, and was discharged or released therefrom with other than a dishonorable discharge; or

(2) Was discharged or released from active duty for a service-connected disability if any part of such active duty was performed between August 5, 1964, and May 7, 1975.

(b) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against the individual because the individual is a disabled veteran or a veteran of the Vietnam era. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified disabled veterans and veterans of the Vietnam era without discrimination based upon their disability or veterans' status in all employment practices such as--

(i) Employment;

(ii) Upgrading;

(iii) Demotion or transfer;

(iv) Recruitment;

(v) Advertising;

(vi) Layoff or termination;

(vii) Rates of pay or other forms of compensation; and

(viii) Selection for training, including apprenticeship.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Vietnam Era Veterans' Readjustment Assistance Act of 1972 (the Act), as amended.

(c) Listing openings. (1) The Contractor agrees to list all employment openings existing at contract award or occurring during contract performance, at an appropriate office of the State employment service system in the locality where the opening occurs. These openings include those occurring at any Contractor facility, including one not connected with performing this contract. An independent corporate affiliate is exempt from this requirement.

(2) State and local government agencies holding Federal contracts of \$10,000 or more shall also list all their employment openings with the appropriate office of the State employment service.

(3) The listing of employment openings with the State employment service system is required at least concurrently with using any other recruitment source or effort and involves the obligations of placing a bona fide job order, including accepting referrals of veterans and nonveterans. This listing does not require hiring any particular job applicant or hiring from any particular group of job applicants and is not intended to relieve the Contractor from any requirements of Executive orders or regulations concerning nondiscrimination in employment.

(4) Whenever the Contractor becomes contractually bound to the listing terms of this clause, it shall advise the State employment service system, in each State where it has establishments, of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these terms and has so advised the State system, it need not advise the State system of subsequent contracts. The Contractor may advise the State system when it is no longer bound by this contract clause.

(d) Applicability. This clause does not apply to the listing of employment openings that occur and are filled outside the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, and the Virgin Islands.

(e) Postings. (1) The Contractor agrees to post employment notices stating (i) the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era, and (ii) the rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. They shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance Programs, Department of Labor (Deputy Assistant Secretary), and provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of the Act, and is committed to take affirmative action to employ, and advance in employment, qualified disabled veterans and veterans of the Vietnam Era.

(f) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(g) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

(End of clause)

52.222-36 AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES (JUN 1998)

(a) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against any employee or applicant because of physical or mental disability. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified individuals with disabilities without discrimination based upon their physical or mental disability in all employment practices such as--

(i) Recruitment, advertising, and job application procedures;

(ii) Hiring, upgrading, promotion, award of tenure, demotion, transfer, layoff, termination, right of return from layoff, and rehiring;

(iii) Rates of pay or any other form of compensation and changes in compensation;

(iv) Job assignments, job classifications, organizational structures, position descriptions, lines of progression, and seniority lists;

(v) Leaves of absence, sick leave, or any other leave;

(vi) Fringe benefits available by virtue of employment, whether or not administered by the Contractor;

(vii) Selection and financial support for training, including apprenticeships, professional meetings, conferences, and other related activities, and selection for leaves of absence to pursue training;

(viii) Activities sponsored by the Contractor, including social or recreational programs; and

(ix) Any other term, condition, or privilege of employment.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Rehabilitation Act of 1973 (29 U.S.C. 793) (the Act), as amended.

(b) Postings. (1) The Contractor agrees to post employment notices stating--

(i) The Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified individuals with disabilities; and

(ii) The rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. The Contractor shall ensure that applicants and employees with disabilities are informed of the contents of the notice (e.g., the Contractor may have the notice read to a visually disabled individual, or may lower the posted notice so that it might be read by a person in a wheelchair). The notices shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance of the U.S. Department of Labor (Deputy Assistant Secretary) and shall be provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act and is committed to take affirmative action to employ, and advance in employment, qualified individuals with physical or mental disabilities.

(c) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(d) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of \$10,000 unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

(End of clause)

52.222-37 EMPLOYMENT REPORTS ON DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA (JAN 1999)

(a) Unless the Contractor is a State or local government agency, the Contractor shall report at least annually, as required by the Secretary of Labor, on--

(1) The number of disabled veterans and the number of veterans of the Vietnam era in the workforce of the contractor by job category and hiring location; and

(2) The total number of new employees hired during the period covered by the report, and of that total, the number of disabled veterans, and the number of veterans of the Vietnam era.

(b) The above items shall be reported by completing the form entitled "Federal Contractor Veterans' Employment Report VETS-100."

(c) Reports shall be submitted no later than September 30 of each year beginning September 30, 1988.

(d) The employment activity report required by paragraph (a)(2) of this clause shall reflect total hires during the most recent 12-month period as of the ending date selected for the employment profile report required by paragraph (a)(1) of this clause. Contractors may select an ending date: (1) As of the end of any pay period during the period January through March 1st of the year the report is due, or (2) as of December 31, if the contractor has previous written approval from the Equal Employment Opportunity

Commission to do so for purposes of submitting the Employer Information Report EEO-1 (Standard Form 100).

(e) The count of veterans reported according to paragraph (a) of this clause shall be based on voluntary disclosure. Each Contractor subject to the reporting requirements at 38 U.S.C. 4212 shall invite all disabled veterans and veterans of the Vietnam era who wish to benefit under the affirmative action program at 38 U.S.C. 4212 to identify themselves to the Contractor. The invitation shall state that the information is voluntarily provided; that the information will be kept confidential; that disclosure or refusal to provide the information will not subject the applicant or employee to any adverse treatment; and that the information will be used only in accordance with the regulations promulgated under 38 U.S.C. 4212.

(f) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary.

(End of clause)

52.223-6 DRUG-FREE WORKPLACE (JAN 1997)

(a) Definitions. As used in this clause --

"Controlled substance" means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11 - 1308.15.

"Conviction" means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes.

"Criminal drug statute" means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession, or use of any controlled substance.

"Drug-free workplace" means the site(s) for the performance of work done by the Contractor in connection with a specific contract at which employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

"Employee" means an employee of a Contractor directly engaged in the performance of work under a Government contract. "Directly engaged" is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

"Individual" means an offeror/contractor that has no more than one employee including the offeror/contractor.

(b) The Contractor, if other than an individual, shall-- within 30 days after award (unless a longer period is agreed to in writing for contracts of 30 days or more performance duration), or as soon as possible for contracts of less than 30 days performance duration--

- (1) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition;
- (2) Establish an ongoing drug-free awareness program to inform such employees about--
 - (i) The dangers of drug abuse in the workplace;
 - (ii) The Contractor's policy of maintaining a drug-free workplace;
 - (iii) Any available drug counseling, rehabilitation, and employee assistance programs; and
 - (iv) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;
- (3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b)(1) of this clause;
- (4) Notify such employees in writing in the statement required by subparagraph (b)(1) of this clause that, as a condition of continued employment on this contract, the employee will--
 - (i) Abide by the terms of the statement; and
 - (ii) Notify the employer in writing of the employee's conviction under a criminal drug statute for a violation occurring in the workplace no later than 5 days after such conviction.
- (5) Notify the Contracting Officer in writing within 10 days after receiving notice under subdivision (b)(4)(ii) of this clause, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee;
- (6) Within 30 days after receiving notice under subdivision (b)(4)(ii) of this clause of a conviction, take one of the following actions with respect to any employee who is convicted of a drug abuse violation occurring in the workplace:
 - (i) Taking appropriate personnel action against such employee, up to and including termination; or
 - (ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency; and
- (7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b)(1) through (b)(6) of this clause.
- (c) The Contractor, if an individual, agrees by award of the contract or acceptance of a purchase order, not to engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance while performing this contract.

(d) In addition to other remedies available to the Government, the Contractor's failure to comply with the requirements of paragraph (b) or (c) of this clause may, pursuant to FAR 23.506, render the Contractor subject to suspension of contract payments, termination of the contract for default, and suspension or debarment.

(End of clause)

52.223-14 TOXIC CHEMICAL RELEASE REPORTING (OCT 2000)

(a) Unless otherwise exempt, the Contractor, as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor owned or operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if--

(1) The facility does not manufacture, process, or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

(2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

(3) The facility does not meet the reporting thresholds of toxic chemicals established under of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

(4) The facility does not fall within Standard Industrial Classification Code (SIC) major groups 20 through 39 or their corresponding North American Industry Classification System (NAICS) sectors 31 through 33; or

(5) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any of its owned or operated facilities used in the performance of this contract is no longer exempt--

(1) The Contractor shall notify the Contracting Officer; and

(2) The Contractor, as owner or operator of a facility used in the performance of this contract that is no longer exempt, shall (i) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year during which the facility becomes eligible; and (ii)

continue to file the annual Form R for the life of the contract for such facility.

(d) The Contracting Officer may terminate this contract or take other action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items, as defined in FAR Part 2, the Contractor shall--

(1) For competitive subcontracts expected to exceed \$100,000 (including all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding \$100,000 (including all options), the substance of this clause, except this paragraph (e).

52.225-9 BUY AMERICAN ACT--BALANCE OF PAYMENTS PROGRAM--CONSTRUCTION MATERIALS (FEB 2000)

(a) Definitions. As used in this clause--

Component means any article, material, or supply incorporated directly into construction materials.

Construction material means an article, material, or supply brought to the construction site by the Contractor or a subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

Cost of components means--

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the end product (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the end product.

Domestic construction material means--

(1) An unmanufactured construction material mined or produced in the United States; or

(2) A construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic.

Foreign construction material means a construction material other than a domestic construction material.

United States means the 50 States and the District of Columbia, U.S. territories and possessions, Puerto Rico, the Northern Mariana Islands, and any other place subject to U.S. jurisdiction, but does not include leased bases.

(b) Domestic preference. (1) This clause implements the Buy American Act (41 U.S.C. 10a-10d) and the Balance of Payments Program by providing a preference for domestic construction material. The Contractor shall use only domestic construction material in performing this contract, except as provided in paragraphs (b)(2) and (b)(3) of this clause.

(2) This requirement does not apply to the construction material or components listed by the Government as follows: None

(3) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(2) of this clause if the Government determines that

(i) The cost of domestic construction material would be unreasonable. The cost of a particular domestic construction material subject to the requirements of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent. For determination of unreasonable cost under the Balance of Payments Program, the Contracting Officer will use a factor of 50 percent;

(ii) The application of the restriction of the Buy American Act or Balance of Payments Program to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) Request for determination of inapplicability of the Buy American Act or Balance of Payments Program. (1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(3) of this clause shall include adequate information for Government evaluation of the request, including--

(A) A description of the foreign and domestic construction materials;

(B) Unit of measure;

(C) Quantity;

(D) Price;

(E) Time of delivery or availability;

(F) Location of the construction project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign construction materials cited in accordance with paragraph (b)(3) of this clause.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.

(iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.

(2) If the Government determines after contract award that an exception to the Buy American Act or Balance of Payments Program applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(3)(i) of this clause.

(3) Unless the Government determines that an exception to the Buy American Act or Balance of Payments Program applies, use of foreign construction material is noncompliant with the Buy American Act or Balance of Payments Program.

(d) Data. To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

Foreign and Domestic Construction Materials Price Comparison			

Construction material description		Unit of measure	
Quantity	Price (dollars) \1\		

Item 1			
Foreign construction material....		
.....		

Domestic construction material... ..

 Item 2

Foreign construction material.... ..

 Domestic construction material... ..

 Include all delivery costs to the construction site and any applicable duty
 (whether or not a duty-free entry
 certificate is issued).

List name, address, telephone number, and contact for suppliers surveyed.
 Attach copy of response; if oral,
 attach summary.

Include other applicable supporting information.

(End of clause)

52.225-13 RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (JUL 2000)

(a) The Contractor shall not acquire, for use in the performance of this contract, any supplies or services originating from sources within, or that were located in or transported from or through, countries whose products are banned from importation into the United States under regulations of the Office of Foreign Assets Control, Department of the Treasury. Those countries are Cuba, Iran, Iraq, Libya, North Korea, Sudan, the territory of Afghanistan controlled by the Taliban, and Serbia (excluding the territory of Kosovo).

(b) The Contractor shall not acquire for use in the performance of this contract any supplies or services from entities controlled by the government of Iraq.

(c) The Contractor shall insert this clause, including this paragraph (c), in all subcontracts.

(End of clause)

52.226-1 UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES (JUN 2000)

(a) Definitions. As used in this clause:

"Indian" means any person who is a member of any Indian tribe, band, group, pueblo or community that is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c) and any ``Native'' as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601).

"Indian organization" means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indian tribe for the purposes of 25 U.S.C., chapter 17.

"Indian-owned economic enterprise" means any Indian-owned (as determined by

the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership constitute a not less than 51 percent of the enterprise.

"Indian tribe" means any Indian tribe, band, group, pueblo or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, that is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1542(c).

"Interested party" means a prime contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

(b) The Contractor shall use its best efforts to give Indian organizations and Indian-owned economic enterprises (25 U.S.C. 1544) the maximum practicable opportunity to participate in the subcontracts it awards to the fullest extent consistent with efficient performance of its contract.

(1) The Contracting Officer and the Contractor, acting in good faith, may rely on the representation of an Indian organization or Indian-owned economic enterprise as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status. In the event of a challenge to the representation of a subcontractor, the Contracting Officer will refer the matter to the U.S. Department of the Interior, Bureau of Indian Affairs (BIA), Attn: Chief, Division of Contracting and Grants Administration, 1849 C Street, NW., MS 2626-MIB, Washington, DC 20240-4000.

The BIA will determine the eligibility and notify the Contracting Officer. No incentive payment will be made within 50 working days of subcontract award or while a challenge is pending. If a subcontractor is determined to be an ineligible participant, no incentive payment will be made under the Indian Incentive Program.

(2) The Contractor may request an adjustment under the Indian Incentive Program to the following:

(i) The estimated cost of a cost-type contract.

(ii) The target cost of a cost-plus-incentive-fee prime contract.

(iii) The target cost and ceiling price of a fixed-price incentive prime contract.

(iv) The price of a firm-fixed-price prime contract.

(3) The amount of the adjustment to the prime contract is 5 percent of the estimated cost, target cost, or firm-fixed-price included in the subcontract initially awarded to the Indian organization or Indian-owned economic enterprise.

(4) The Contractor has the burden of proving the amount claimed and must assert its request for an adjustment prior to completion of contract performance.

(c) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, will authorize an incentive payment of 5 percent of the amount paid to the subcontractor. The Contracting Officer will seek funding in accordance with agency procedures.

(End of clause)

52.227-1 AUTHORIZATION AND CONSENT (JUL 1995)

(a) The Government authorizes and consents to all use and manufacture, in performing this contract or any subcontract at any tier, of any invention described in and covered by a United States patent (1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or (2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with (i) specifications or written provisions forming a part of this contract or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold (however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.)

52.227-4 PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984)

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any United States patent (except a patent issued upon an application that is now or may hereafter be withheld from issue pursuant to a Secrecy Order under 35 U.S.C. 181) arising out of performing this contract or out of the use or disposal by or for the account of the Government of supplies furnished or work performed under this contract.

52.228-1 BID GUARANTEE (SEP 1996)

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm

commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.-

(c) The amount of the bid guarantee shall be _____ percent of the bid price or \$_____, whichever is less.-

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.-

(e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

52.228-2 ADDITIONAL BOND SECURITY (OCT 1997)

The Contractor shall promptly furnish additional security required to protect the Government and persons supplying labor or materials under this contract if--

(a) Any surety upon any bond, or issuing financial institution for other security, furnished with this contract becomes unacceptable to the Government.

(b) Any surety fails to furnish reports on its financial condition as required by the Government;

(c) The contract price is increased so that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer; or

(d) An irrevocable letter of credit (ILC) used as security will expire before the end of the period of required security. If the Contractor does not furnish an acceptable extension or replacement ILC, or other acceptable substitute, at least 30 days before an ILC's scheduled expiration, the Contracting officer has the right to immediately draw on the ILC.

52.228-5 INSURANCE--WORK ON A GOVERNMENT INSTALLATION (JAN 1997)

(a) The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract, at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(b) Before commencing work under this contract, the Contractor shall notify the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change

adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribe, or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

(End of clause)

52.228-11 PLEDGES OF ASSETS (FEB 1992)

(a) Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond--

(1) Pledge of assets; and

(2) Standard Form 28, Affidavit of Individual Surety.

(b) Pledges of assets from each person acting as an individual surety shall be in the form of--

(1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government securities held in book entry form) and/or;

(2) A recorded lien on real estate. The offeror will be required to provide--

(i) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owners; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(ii) Evidence of the amount due under any encumbrance shown in the evidence of title;

(iii) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation.

(End of clause)

52.228-12 PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS. (OCT 1995)

In accordance with Section 806(a)(3) of Pub. L. 102-190, as amended by

Sections 2091 and 8105 of Pub. L. 103-355, upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

52.228-14 IRREVOCABLE LETTER OF CREDIT (DEC 1999)

(a) "Irrevocable letter of credit" (ILC), as used in this clause, means a written commitment by a federally insured financial institution to pay all or part of a stated amount of money, until the expiration date of the letter, upon presentation by the Government (the beneficiary) of a written demand therefor. Neither the financial institution nor the offeror/Contractor can revoke or condition the letter of credit.

(b) If the offeror intends to use an ILC in lieu of a bid bond, or to secure other types of bonds such as performance and payment bonds, the letter of credit and letter of confirmation formats in paragraphs (e) and (f) of this clause shall be used.

(c) The letter of credit shall be irrevocable, shall require presentation of no document other than a written demand and the ILC (including confirming letter, if any), shall be issued/confirmed by an acceptable federally insured financial institution as provided in paragraph (d) of this clause, and--

(1) If used as a bid guarantee, the ILC shall expire no earlier than 60 days after the close of the bid acceptance period;

(2) If used as an alternative to corporate or individual sureties as security for a performance or payment bond, the offeror/Contractor may submit an ILC with an initial expiration date estimated to cover the entire period for which financial security is required or may submit an ILC with an initial expiration date that is a minimum period of one year from the date of issuance. The ILC shall provide that, unless the issuer provides the beneficiary written notice of non-renewal at least 60 days in advance of the current expiration date, the ILC is automatically extended without amendment for one year from the expiration date, or any future expiration date, until the period of required coverage is completed and the Contracting Officer provides the financial institution with a written statement waiving the right to payment. The period of required coverage shall be:

(i) For contracts subject to the Miller Act, the later of--

(A) One year following the expected date of final payment;

(B) For performance bonds only, until completion of any warranty period; or

(C) For payment bonds only, until resolution of all claims filed against the payment bond during the one-year period following final payment.

(ii) For contracts not subject to the Miller Act, the later of--

(A) 90 days following final payment; or

(B) For performance bonds only, until completion of any warranty period.

(d) Only federally insured financial institutions rated investment grade or higher shall issue or confirm the ILC. The offeror/Contractor shall provide the Contracting Officer a credit rating that indicates the financial institution has the required rating(s) as of the date of issuance of the ILC. Unless the financial institution issuing the ILC had letter of credit business of less than \$25 million in the past year, ILCs over \$5 million must be confirmed by another acceptable financial institution that had letter of credit business of less than \$25 million in the past year.

(e) The following format shall be used by the issuing financial institution to create an ILC:

[Issuing Financial Institution's Letterhead or Name and Address]

Issue Date _____

IRREVOCABLE LETTER OF CREDIT NO. _____

Account party's name _____

Account party's address _____

For Solicitation No. _____(for reference only)

TO: [U.S. Government agency]

[U.S. Government agency's address]

1. We hereby establish this irrevocable and transferable Letter of Credit in your favor for one or more drawings up to United States \$_____. This Letter of Credit is payable at [issuing financial institution's and, if any, confirming financial institution's] office at [issuing financial institution's address and, if any, confirming financial institution's address] and expires with our close of business on _____, or any automatically extended expiration date.

2. We hereby undertake to honor your or the transferee's sight draft(s) drawn on the issuing or, if any, the confirming financial institution, for all or any part of this credit if presented with this Letter of Credit and confirmation, if any, at the office specified in paragraph 1 of this Letter of Credit on or before the expiration date or any automatically extended expiration date.

3. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this Letter of Credit that it is deemed to be automatically extended without amendment for one year from the expiration date hereof, or any future expiration date, unless at least 60 days prior to any expiration date, we notify you or the transferee by registered mail, or other receipted means of delivery, that we elect not to consider this Letter of Credit renewed for any such additional period. At the time we notify you, we also agree to notify the account party (and confirming financial institution, if any) by the same means of delivery.

4. This Letter of Credit is transferable. Transfers and assignments of proceeds are to be effected without charge to either the beneficiary or the transferee/assignee of proceeds. Such transfer or assignment shall be only at the written direction of the Government (the beneficiary) in a form satisfactory to the issuing financial institution and the confirming financial institution, if any.

5. This Letter of Credit is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ [state of confirming financial institution, if any, otherwise state of issuing financial institution].

6. If this credit expires during an interruption of business of this financial institution as described in Article 17 of the UCP, the financial institution specifically agrees to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

[Issuing financial institution]

(f) The following format shall be used by the financial institution to confirm an ILC:

[Confirming Financial Institution's Letterhead or Name and Address]

(Date) _____

Our Letter of Credit Advice Number _____

Beneficiary: _____ [U.S. Government agency]

Issuing Financial Institution: _____

Issuing Financial Institution's LC No.: _____

Gentlemen:

1. We hereby confirm the above indicated Letter of Credit, the original of which is attached, issued by _____ [name of issuing financial institution] for drawings of up to United States dollars _____/U.S. \$_____ and expiring with our close of business on _____ [the expiration date], or any automatically extended expiration date.

2. Draft(s) drawn under the Letter of Credit and this Confirmation are payable at our office located at _____.

3. We hereby undertake to honor sight draft(s) drawn under and presented with the Letter of Credit and this Confirmation at our offices as specified herein.

4. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this confirmation that it be deemed automatically extended without amendment for one year from the expiration date hereof, or any automatically extended expiration date, unless:

(a) At least 60 days prior to any such expiration date, we shall notify the Contracting Officer, or the transferee and the issuing financial institution, by registered mail or other receipted means of delivery, that we elect not to consider this confirmation extended for any such additional period; or

(b) The issuing financial institution shall have exercised its right to notify you or the transferee, the account party, and ourselves, of its election not to extend the expiration date of the Letter of Credit.

5. This confirmation is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ [state of confirming financial institution].

6. If this confirmation expires during an interruption of business of this financial institution as described in Article 17 of the UCP, we specifically agree to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

[Confirming financial institution]

(g) The following format shall be used by the Contracting Officer for a sight draft to draw on the Letter of Credit:

SIGHT DRAFT

[City, State]

(Date) _____

[Name and address of financial institution]

Pay to the order of _____ [Beneficiary Agency] _____ the sum of United States \$_____. This draft is drawn under Irrevocable Letter of Credit No. _____.

[Beneficiary Agency]

By: _____

(End of clause)

52.228-15 PERFORMANCE AND PAYMENT BONDS--CONSTRUCTION (JUL 2000)-

(a) Definitions. As used in this clause--

Original contract price means the award price of the contract; or, for requirements contracts, the price payable for the estimated total quantity; or, for indefinite-quantity contracts, the price payable for the specified minimum quantity. Original contract price does not include the price of any options, except those options exercised at the time of contract award.

(b) Amount of required bonds. Unless the resulting contract price is \$100,000 or less, the successful offeror shall furnish performance and payment bonds to the Contracting Officer as follows:

(1) Performance bonds (Standard Form 25). The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract price.

(2) Payment Bonds (Standard Form 25-A). The penal amount of payment bonds at the time of contract award shall be 100 percent of the original contract price.

(3) Additional bond protection. (i) The Government may require additional performance and payment bond protection if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.

(ii) The Government may secure the additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.

(c) Furnishing executed bonds. The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, within the time period specified in the Bid Guarantee provision of the solicitation, or otherwise specified by the Contracting Officer, but in any event, before starting work.

(d) Surety or other security for bonds. The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register or may be obtained from the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch, 401 14th Street, NW, 2nd Floor, West Wing, Washington, DC 20227.

(e) Notice of subcontractor waiver of protection (40 U.S.C. 270b(c)). Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the contract.

(End of clause)

52.229-3 FEDERAL, STATE, AND LOCAL TAXES (JAN 1991)

(a) "Contract date," as used in this clause, means the date set for bid opening or, if this is a negotiated contract or a modification, the effective date of this contract or modification.

"All applicable Federal, State, and local taxes and duties," as used in this clause, means all taxes and duties, in effect on the contract date, that the taxing authority is imposing and collecting on the transactions or property covered by this contract.

"After-imposed Federal tax," as used in this clause, means any new or increased Federal excise tax or duty, or tax that was exempted or excluded on the contract date but whose exemption was later revoked or reduced during the contract period, on the transactions or property covered by this contract that the Contractor is required to pay or bear as the result of legislative, judicial, or administrative action taking effect after the contract date. It does not include social security tax or other employment taxes.

"After-relieved Federal tax," as used in this clause, means any amount of Federal excise tax or duty, except social security or other employment taxes, that would otherwise have been payable on the transactions or property covered by this contract, but which the Contractor is not required to pay or bear, or for which the Contractor obtains a refund or drawback, as the result of legislative, judicial, or administrative action taking effect after the contract date.

(b) The contract price includes all applicable Federal, State, and local taxes and duties.

(c) The contract price shall be increased by the amount of any after-imposed Federal tax, provided the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price, as a contingency reserve or otherwise.

(d) The contract price shall be decreased by the amount of any after-relieved Federal tax.

(e) The contract price shall be decreased by the amount of any Federal excise tax or duty, except social security or other employment taxes, that the Contractor is required to pay or bear, or does not obtain a refund of, through the Contractor's fault, negligence, or failure to follow instructions of the Contracting Officer.

(f) No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceeds \$250.

(g) The Contractor shall promptly notify the Contracting Officer of all matters relating to any Federal excise tax or duty that reasonably may be expected to result in either an increase or decrease in the contract price and shall take appropriate action as the Contracting Officer directs.

(h) The Government shall, without liability, furnish evidence appropriate to establish exemption from any Federal, State, or local tax when the Contractor requests such evidence and a reasonable basis exists to sustain the exemption.

(End of clause)

52.229-5 TAXES--CONTRACTS PERFORMED IN U.S. POSSESSIONS OR PUERTO RICO
(APR 1984)

The term "local taxes," as used in the Federal, State, and local taxes clause of this contract, includes taxes imposed by a possession of the United States or by Puerto Rico.

(End of clause)

52.232-5 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (MAY 1997)

(a) Payment of price. The Government shall pay the Contractor the contract price as provided in this contract.

(b) Progress payments. The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer.

(1) The Contractor's request for progress payments shall include the following substantiation:

(i) An itemization of the amounts requested, related to the various elements of work required by the contract covered by the payment requested.

(ii) A listing of the amount included for work performed by each subcontractor under the contract.

(iii) A listing of the total amount of each subcontract under the contract.

(iv) A listing of the amounts previously paid to each such subcontractor under the contract.

(v) Additional supporting data in a form and detail required by the Contracting Officer.

(2) In the preparation of estimates, the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site also may be taken into consideration if--

(i) Consideration is specifically authorized by this contract; and

(ii) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) Contractor certification. Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made: (However, if the Contractor elects to delete paragraph (c)(4) from the certification, the certification is still acceptable.)

I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of chapter 39 of Title 31, United States Code;

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and

(4) This certification is not to be construed as final acceptance of a subcontractor's performance.

(Name)

(Title)

(Date)

(d) Refund of unearned amounts. If the Contractor, after making a certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this contract (hereinafter referred to as the "unearned amount"), the Contractor shall--

(1) Notify the Contracting Officer of such performance deficiency; and

(2) Be obligated to pay the Government an amount (computed by the Contracting Officer in the manner provided in paragraph (j) of this clause) equal to interest on the unearned amount from the 8th day after the date of receipt of the unearned amount until--

(i) The date the Contractor notifies the Contracting Officer that the performance deficiency has been corrected; or

(ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

(e) Retainage. If the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved. When the work is substantially complete, the Contracting Officer may retain from previously withheld funds and future progress payments that amount the Contracting Officer considers adequate for

protection of the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the contract, for which the price is stated separately in the contract, payment shall be made for the completed work without retention of a percentage.

(f) Title, liability, and reservation of rights. All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

(1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

(2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(g) Reimbursement for bond premiums. In making these progress payments, the Government shall, upon request, reimburse the Contractor for the amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor has furnished evidence of full payment to the surety. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of progress payments attributable to bond premiums.

(h) Final payment. The Government shall pay the amount due the Contractor under this contract after--

(1) Completion and acceptance of all work;

(2) Presentation of a properly executed voucher; and

(3) Presentation of release of all claims against the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U.S.C. 3727 and 41 U.S.C. 15).

(i) Limitation because of undefinitized work. Notwithstanding any provision of this contract, progress payments shall not exceed 80 percent on work accomplished on undefinitized contract actions. A "contract action" is any action resulting in a contract, as defined in FAR Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes.

(j) Interest computation on unearned amounts. In accordance with 31 U.S.C. 3903(c)(1), the amount payable under subparagraph (d)(2) of this clause shall be--

(1) Computed at the rate of average bond equivalent rates of 91-day Treasury bills auctioned at the most recent auction of such bills prior to the date the Contractor receives the unearned amount; and

(2) Deducted from the next available payment to the Contractor.

52.232-17 INTEREST (JUNE 1996)

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid. reproduce, prepare derivative works, distribute copies to the public, and (b) Amounts shall be due at the earliest of the following dates:

(1) The date fixed under this contract.

(2) The date of the first written demand for payment consistent with this contract, including any demand resulting from a default termination.

(3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.

(4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.

(c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

52.232-23 ASSIGNMENT OF CLAIMS (JAN 1986) - ALTERNATE I (APR 1984)

(a) The Contractor, under the Assignment of Claims Act, as amended, 31 U.S.C. 3727, 41 U.S.C. 15 (hereafter referred to as "the Act"), may assign its rights to be paid amounts due or to become due as a result of the performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency. The assignee under such an assignment may thereafter further assign or reassign its right under the original assignment to any type of financing institution described in the preceding sentence. Unless otherwise stated in this contract, payments to an assignee of any amounts due or to become due under this contract shall not, to the extent specified in the Act, be subject to reduction or setoff.

(b) Any assignment or reassignment authorized under the Act and this clause shall cover all unpaid amounts payable under this contract, and shall not be

made to more than one party, except that an assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in the financing of this contract.

(c) The Contractor shall not furnish or disclose to any assignee under this contract any classified document (including this contract) or information related to work under this contract until the Contracting Officer authorizes such action in writing.

52.232-27 PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (JUN 1997)

Notwithstanding any other payment terms in this contract, the Government will make invoice payments and contract financing payments under the terms and conditions specified in this clause. Payment shall be considered as being made on the day a check is dated or the date of an electronic funds transfer. Definitions of pertinent terms are set forth in section 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see subparagraph (a)(3) concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) Invoice payments. (1) Types of invoice payments. For purposes of this clause, there are several types of invoice payments that may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project:

(A) The due date for making such payments shall be 25 days after receipt of the payment request by the designated billing office. If the designated billing office fails to annotate the payment request with the actual date of receipt at the time of receipt, the payment due date shall be the 25th day after the date of the Contractor's payment request, provided a proper payment request is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, shall be as specified in the contract or, if not specified, 30 days after approval for release to the Contractor by the Contracting Officer.

(ii) Final payments based on completion and acceptance of all work and presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the Government (e.g., each separate building, public work, or other division of the contract for which the price is stated separately in the contract):

(A) The due date for making such payments shall be either the 30th day after receipt by the designated billing office of a proper invoice from the Contractor, or the 30th day after Government acceptance of the work or services completed by the Contractor, whichever is later. If the designated billing office fails to annotate the invoice with the date of actual receipt

at the time of receipt, the invoice payment due date shall be the 30th day after the date of the Contractor's invoice, provided a proper invoice is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) On a final invoice where the payment amount is subject to contract settlement actions (e.g., release of claims), acceptance shall be deemed to have occurred on the effective date of the contract settlement.

(2) Contractor's invoice. The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in subdivisions (a)(2)(i) through (a)(2)(ix) of this clause. If the invoice does not comply with these requirements, it shall be returned within 7 days after the date the designated billing office received the invoice, with a statement of the reasons why it is not a proper invoice. Untimely notification will be taken into account in computing any interest penalty owed the Contractor in the manner described in subparagraph (a)(4) of this clause.

(i) Name and address of the Contractor.

(ii) Invoice date. (The Contractor is encouraged to date invoices as close as possible to the date of mailing or transmission.)

(iii) Contract number or other authorization for work or services performed (including order number and contract line item number).

(iv) Description of work or services performed.

(v) Delivery and payment terms (e.g., prompt payment discount terms).

(vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).

(vii) Name (where practicable), title, phone number, and mailing address of person to be notified in the event of a defective invoice.

(viii) For payments described in subdivision (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts.

(ix) Any other information or documentation required by the contract.

(x) While not required, the Contractor is strongly encouraged to assign an identification number to each invoice.

(3) Interest penalty. An interest penalty shall be paid automatically by the designated payment office, without request from the Contractor, if payment is not made by the due date and the conditions listed in subdivisions (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday when Federal Government offices are closed and Government business is not expected to be conducted, payment may be made on the following business day without incurring a late payment interest penalty.

(i) A proper invoice was received by the designated billing office.

(ii) A receiving report or other Government documentation authorizing payment was processed and there was no disagreement over quantity, quality, Contractor compliance with any contract term or condition, or requested progress payment amount.

(iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) Computing penalty amount. The interest penalty shall be at the rate established by the Secretary of the Treasury under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) that is in effect on the day after the due date, except where the interest penalty is prescribed by other governmental authority (e.g., tariffs). This rate is referred to as the "Renegotiation Board Interest Rate," and it is published in the Federal Register semiannually on or about January 1 and July 1. The interest penalty shall accrue daily on the invoice principal payment amount approved by the Government until the payment date of such approved principal amount; and will be compounded in 30-day increments inclusive from the first day after the due date through the payment date. That is, interest accrued at the end of any 30-day period will be added to the approved invoice principal payment amount and will be subject to interest penalties if not paid in the succeeding 30-day period. If the designated billing office failed to notify the Contractor of a defective invoice within the periods prescribed in subparagraph (a)(2) of this clause, the due date on the corrected invoice will be adjusted by subtracting from such date the number of days taken beyond the prescribed notification of defects period. Any interest penalty owed the Contractor will be based on this adjusted due date. Adjustments will be made by the designated payment office for errors in calculating interest penalties.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in subdivision (a)(1)(ii) of this clause, Government acceptance or approval shall be deemed to have occurred constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. In the event that actual acceptance or approval occurs within the constructive acceptance or approval period, the determination of an interest penalty shall be based on the actual date of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contractor estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The following periods of time will not be included in the determination of an interest penalty:

(A) The period taken to notify the Contractor of defects in invoices submitted to the Government, but this may not exceed 7 days.

(B) The period between the defects notice and resubmission of the corrected

invoice by the Contractor.

(C) For incorrect electronic funds transfer (EFT) information, in accordance with the EFT clause of this contract.

(iii) Interest penalties will not continue to accrue after the filing of a claim for such penalties under the clause at 52.233-1, Disputes, or for more than 1 year. Interest penalties of less than \$1 need not be paid.

(iv) Interest penalties are not required on payment delays due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. Claims involving disputes, and any interest that may be payable, will be resolved in accordance with the clause at 52.233-1, Disputes.

(5) Prompt payment discounts. An interest penalty also shall be paid automatically by the designated payment office, without request from the Contractor, if a discount for prompt payment is taken improperly. The interest penalty will be calculated on the amount of discount taken for the period beginning with the first day after the end of the discount period through the date when the Contractor is paid.

(6) Additional interest penalty. (i) If this contract was awarded on or after October 1, 1989, a penalty amount, calculated in accordance with subdivision (a)(6)(iii) of this clause, shall be paid in addition to the interest penalty amount if the Contractor--

(A) Is owed an interest penalty of \$1 or more;

(B) Is not paid the interest penalty within 10 days after the date the invoice amount is paid; and

(C) Makes a written demand to the designated payment office for additional penalty payment, in accordance with subdivision (a)(6)(ii) of this clause, postmarked not later than 40 days after the date the invoice amount is paid.

(ii)(A) Contractors shall support written demands for additional penalty payments with the following data. No additional data shall be required. Contractors shall--

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest was due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) Demands must be postmarked on or before the 40th day after payment was made, except that--

(1) If the postmark is illegible or nonexistent, the demand must have been received and annotated with the date of receipt by the designated payment

office on or before the 40th day after payment was made; or

(2) If the postmark is illegible or nonexistent and the designated payment office fails to make the required annotation, the demand's validity will be determined by the date the Contractor has placed on the demand; provided such date is no later than the 40th day after payment was made.

(iii)(A) The additional penalty shall be equal to 100 percent of any original late payment interest penalty, except--

(1) The additional penalty shall not exceed \$5,000;

(2) The additional penalty shall never be less than \$25; and

(3) No additional penalty is owed if the amount of the underlying interest penalty is less than \$1.

(B) If the interest penalty ceases to accrue in accordance with the limits stated in subdivision (a)(4)(iii) of this clause, the amount of the additional penalty shall be calculated on the amount of interest penalty that would have accrued in the absence of these limits, subject to the overall limits on the additional penalty specified in subdivision (a)(6)(iii)(A) of this clause.

(C) For determining the maximum and minimum additional penalties, the test shall be the interest penalty due on each separate payment made for each separate contract. The maximum and minimum additional penalty shall not be based upon individual invoices unless the invoices are paid separately. Where payments are consolidated for disbursing purposes, the maximum and minimum additional penalty determination shall be made separately for each contract therein.

(D) The additional penalty does not apply to payments regulated by other Government regulations (e.g., payments under utility contracts subject to tariffs and regulation).

(b) Contract financing payments. (1) Due dates for recurring financing payments. If this contract provides for contract financing, requests for payment shall be submitted to the designated billing office as specified in this contract or as directed by the Contracting Officer. Contract financing payments shall be made on the 30th day after receipt of a proper contract financing request by the designated billing office. In the event that an audit or other review of a specific financing request is required to ensure compliance with the terms and conditions of the contract, the designated payment office is not compelled to make payment by the due date specified.

(2) Due dates for other contract financing. For advance payments, loans, or other arrangements that do not involve recurring submissions of contract financing requests, payment shall be made in accordance with the corresponding contract terms or as directed by the Contracting Officer.

(3) Interest penalty not applicable. Contract financing payments shall not be assessed an interest penalty for payment delays.

(c) Subcontract clause requirements. The Contractor shall include in each subcontract for property or services (including a material supplier) for the

purpose of performing this contract the following:

(1) Prompt payment for subcontractors. A payment clause that obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under this contract.

(2) Interest for subcontractors. An interest penalty clause that obligates the Contractor to pay to the subcontractor an interest penalty for each payment not made in accordance with the payment clause--

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due is made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(3) Subcontractor clause flowdown. A clause requiring each subcontractor to include a payment clause and an interest penalty clause conforming to the standards set forth in subparagraphs (c)(1) and (c)(2) of this clause in each of its subcontracts, and to require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.

(d) Subcontract clause interpretation. The clauses required by paragraph (c) of this clause shall not be construed to impair the right of the Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions that--

(1) Retainage permitted. Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to by the parties to the subcontract, giving such recognition as the parties deem appropriate to the ability of a subcontractor to furnish a performance bond and a payment bond;

(2) Withholding permitted. Permit the Contractor or subcontractor to make a determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and

(3) Withholding requirements. Permit such withholding without incurring any obligation to pay a late payment penalty if--

(i) A notice conforming to the standards of paragraph (g) of this clause previously has been furnished to the subcontractor; and

(ii) A copy of any notice issued by a Contractor pursuant to subdivision (d)(3)(i) of this clause has been furnished to the Contracting Officer.

(e) Subcontractor withholding procedures. If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such

subcontractor is subject to withholding from the subcontractor in accordance with the subcontract agreement, then the Contractor shall--

(1) Subcontractor notice. Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;

(2) Contracting Officer notice. Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to subparagraph (e)(1) of this clause;

(3) Subcontractor progress payment reduction. Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under subparagraph (e)(1) of this clause;

(4) Subsequent subcontractor payment. Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and--

(i) Make such payment within--

(A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefor must be recovered from the Government because of a reduction under subdivision (e)(5)(i)) of this clause; or

(B) Seven days after the Contractor recovers such funds from the Government; or

(ii) Incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) Notice to Contracting Officer. Notify the Contracting Officer upon--

(i) Reduction of the amount of any subsequent certified application for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment, specifying--

(A) The amounts withheld under subparagraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) Interest to Government. Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C. 3903(c)(1)), from the 8th day after receipt of the withheld amounts from the Government until--

(i) The day the identified subcontractor performance deficiency is corrected; or

(ii) The date that any subsequent payment is reduced under subdivision

(e)(5)(i) of this clause.

(f) Third-party deficiency reports. (1) Withholding from subcontractor. If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a "second-tier subcontractor") a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a deficiency in such first-tier subcontractor's performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, the Contractor may, without incurring an obligation to pay an interest penalty under subparagraph (e)(6) of this clause--

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor's next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under subdivision (f)(1)(i) of this clause.

(2) Subsequent payment or interest charge. As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall--

(i) Pay the amount withheld under subdivision (f)(1)(ii) of this clause to such first-tier subcontractor; or

(ii) Incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) Written notice of subcontractor withholding. A written notice of any withholding shall be issued to a subcontractor (with a copy to the Contracting Officer of any such notice issued by the Contractor), specifying--
-

(1) The amount to be withheld;

(2) The specific causes for the withholding under the terms of the subcontract; and

(3) The remedial actions to be taken by the subcontractor in order to receive payment of the amounts withheld.

(h) Subcontractor payment entitlement. The Contractor may not request payment from the Government of any amount withheld or retained in accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) Prime-subcontractor disputes. A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the United States is a party. The United States may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) Preservation of prime-subcontractor rights. Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) Non-recourse for prime contractor interest penalty. The Contractor's obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the United States for such interest penalty. A cost-reimbursement claim may not include any amount for reimbursement of such interest penalty.

52.232-34 PAYMENT BY ELECTRONIC FUNDS TRANSFER—OTHER THAN CENTRAL CONTRACTOR REGISTRATION (MAY 1999)

(a) Method of payment. (1) All payments by the Government under this contract shall be made by electronic funds transfer (EFT) except as provided in paragraph (a)(2) of this clause. As used in this clause, the term "EFT" refers to the funds transfer and may also include the payment information transfer.

(2) In the event the Government is unable to release one or more payments by EFT, the Contractor agrees to either--

(i) Accept payment by check or some other mutually agreeable method of payment; or

(ii) Request the Government to extend payment due dates until such time as the Government makes payment by EFT (but see paragraph (d) of this clause).

(b) Mandatory submission of Contractor's EFT information. (1) The Contractor is required to provide the Government with the information required to make payment by EFT (see paragraph (j) of this clause). The Contractor shall provide this information directly to the office designated in this contract to receive that information (hereafter: "designated office") by no later than 15 days prior to submission of the first request for payment. If not otherwise specified in this contract, the payment office is the designated office for receipt of the Contractor's EFT information. If more than one designated office is named for the contract, the Contractor shall provide a separate notice to each office. In the event that the EFT information changes, the Contractor shall be responsible for providing the updated information to the designated office(s).

(2) If the Contractor provides EFT information applicable to multiple contracts, the Contractor shall specifically state the applicability of this EFT information in terms acceptable to the designated office. However, EFT information supplied to a designated office shall be applicable only to contracts that identify that designated office as the office to receive EFT information for that contract.

(c) Mechanisms for EFT payment. The Government may make payment by EFT through either the Automated Clearing House (ACH) network, subject to the rules of the National Automated Clearing House Association, or the Fedwire Transfer System. The rules governing Federal payments through the ACH are contained in 31 CFR part 210.

(d) Suspension of payment. (1) The Government is not required to make any payment under this contract until after receipt, by the designated office, of the correct EFT payment information from the Contractor. Until receipt of the correct EFT information, any invoice or contract financing request shall be deemed not to be a proper invoice for the purpose of prompt payment under this contract. The prompt payment terms of the contract regarding notice of an improper invoice and delays in accrual of interest penalties apply.

(2) If the EFT information changes after submission of correct EFT information, the Government shall begin using the changed EFT information no later than 30 days after its receipt by the designated office to the extent payment is made by EFT. However, the Contractor may request that no further payments be made until the updated EFT information is implemented by the payment office. If such suspension would result in a late payment under the prompt payment terms of this contract, the Contractor's request for suspension shall extend the due date for payment by the number of days of the suspension.

(e) Liability for uncompleted or erroneous transfers. (1) If an uncompleted or erroneous transfer occurs because the Government used the Contractor's EFT information incorrectly, the Government remains responsible for--

- (i) Making a correct payment;
- (ii) Paying any prompt payment penalty due; and
- (iii) Recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because the Contractor's EFT information was incorrect, or was revised within 30 days of Government release of the EFT payment transaction instruction to the Federal Reserve System, and--

(i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the Contractor is responsible for recovery of any erroneously directed funds; or

(ii) If the funds remain under the control of the payment office, the Government shall not make payment and the provisions of paragraph (d) shall apply.

(f) EFT and prompt payment. A payment shall be deemed to have been made in a timely manner in accordance with the prompt payment terms of this contract

if, in the EFT payment transaction instruction released to the Federal Reserve System, the date specified for settlement of the payment is on or before the prompt payment due date, provided the specified payment date is a valid date under the rules of the Federal Reserve System.

(g) EFT and assignment of claims. If the Contractor assigns the proceeds of this contract as provided for in the assignment of claims terms of this contract, the Contractor shall require as a condition of any such assignment, that the assignee shall provide the EFT information required by paragraph (j) of this clause to the designated office, and shall be paid by EFT in accordance with the terms of this clause. In all respects, the requirements of this clause shall apply to the assignee as if it were the Contractor. EFT information that shows the ultimate recipient of the transfer to be other than the Contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of paragraph (d) of this clause.

(h) Liability for change of EFT information by financial agent. The Government is not liable for errors resulting from changes to EFT information provided by the Contractor's financial agent.

(i) Payment information. The payment or disbursing office shall forward to the Contractor available payment information that is suitable for transmission as of the date of release of the EFT instruction to the Federal Reserve System. The Government may request the Contractor to designate a desired format and method(s) for delivery of payment information from a list of formats and methods the payment office is capable of executing. However, the Government does not guarantee that any particular format or method of delivery is available at any particular payment office and retains the latitude to use the format and delivery method most convenient to the Government. If the Government makes payment by check in accordance with paragraph (a) of this clause, the Government shall mail the payment information to the remittance address in the contract.

(j) EFT information. The Contractor shall provide the following information to the designated office. The Contractor may supply this data for this or multiple contracts (see paragraph (b) of this clause). The Contractor shall designate a single financial agent per contract capable of receiving and processing the EFT information using the EFT methods described in paragraph (c) of this clause.

(1) The contract number (or other procurement identification number).

(2) The Contractor's name and remittance address, as stated in the contract(s).

(3) The signature (manual or electronic, as appropriate), title, and telephone number of the Contractor official authorized to provide this information.

(4) The name, address, and 9-digit Routing Transit Number of the Contractor's financial agent.

(5) The Contractor's account number and the type of account (checking, saving, or lockbox).

(6) If applicable, the Fedwire Transfer System telegraphic abbreviation of the Contractor's financial agent.

(7) If applicable, the Contractor shall also provide the name, address, telegraphic abbreviation, and 9-digit Routing Transit Number of the correspondent financial institution receiving the wire transfer payment if the Contractor's financial agent is not directly on-line to the Fedwire Transfer System; and, therefore, not the receiver of the wire transfer payment.

(End of clause)

52.233-1 DISPUTES. (DEC 1998)

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) "Claim," as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. A claim arising under a contract, unlike a claim relating to that contract, is a claim that can be resolved under a contract clause that provides for the relief sought by the claimant. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding \$100,000 is not a claim under the Act until certified as required by subparagraph (d)(2) of this clause. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.

(2)(i) The contractors shall provide the certification specified in subparagraph (d)(2)(iii) of this clause when submitting any claim -

(A) Exceeding \$100,000; or

(B) Regardless of the amount claimed, when using -

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

(ii) The certification requirement does not apply to issues in controversy

that have not been submitted as all or part of a claim.

(iii) The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor.

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of \$100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over \$100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use alternative dispute resolution (ADR). If the Contractor refuses an offer for ADR, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the request.

(h) The Government shall pay interest on the amount found due and unpaid from (1) the date the Contracting Officer receives the claim (certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in (FAR) 48 CFR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer.

(End of clause)

52.233-3 PROTEST AFTER AWARD (AUG. 1996)

(a) Upon receipt of a notice of protest (as defined in FAR 33.101) or a determination that a protest is likely (see FAR 33.102(d)), the Contracting Officer may, by written order to the Contractor, direct the Contractor to stop performance of the work called for by this contract. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable

to the work covered by the order during the period of work stoppage. Upon receipt of the final decision in the protest, the Contracting Officer shall either--

(1) Cancel the stop-work order; or

(2) Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the Government, clause of this contract.

(b) If a stop-work order issued under this clause is canceled either before or after a final decision in the protest, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if--

(1) The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and

(2) The Contractor asserts its right to an adjustment within 30 days after the end of the period of work stoppage; provided, that if the Contracting Officer decides the facts justify the action, the Contracting Officer may receive and act upon a proposal at any time before final payment under this contract.

(c) If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.

(d) If a stop-work order is not canceled and the work covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

(e) The Government's rights to terminate this contract at any time are not affected by action taken under this clause.

(f) If, as the result of the Contractor's intentional or negligent misstatement, misrepresentation, or miscertification, a protest related to this contract is sustained, and the Government pays costs, as provided in FAR 33.102(b)(2) or 33.104(h)(1), the Government may require the Contractor to reimburse the Government the amount of such costs. In addition to any other remedy available, and pursuant to the requirements of Subpart 32.6, the Government may collect this debt by offsetting the amount against any payment due the Contractor under any contract between the Contractor and the Government.

52.236-2 DIFFERING SITE CONDITIONS (APR 1984)

As prescribed in 36.502, insert the following clause in solicitations and contracts when a fixed-price construction contract or a fixed-price dismantling, demolition, or removal of improvements contract is contemplated and the contract amount is expected to exceed the small purchase limitation. The Contracting Officer may insert the clause in solicitations and contracts

when a fixed-price construction or a fixed-price contract for dismantling, demolition, or removal of improvements is contemplated and the contract amount is expected to be within the small purchase limitation.

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of

(1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or

(2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; provided, that the time prescribed in (a) above for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

52.236-3 SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984)

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to

(1) conditions bearing upon transportation, disposal, handling, and storage of materials;

(2) the availability of labor, water, electric power, and roads;

(3) uncertainties of weather, river stages, tides, or similar physical conditions at the site;

(4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of

successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

(b) The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

52.236-4 PHYSICAL DATA (APR 1984)

Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

(a) The indications of physical conditions on the drawings and in the specifications are the result of site investigations by the Government.

(b) Weather conditions: The Contractor shall satisfy himself/herself as to the hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from any U.S. Weather Bureau Office.

(c) Transportation Facilities: The Contractor shall make his/her own investigation of the conditions of existing public and private roads and of clearances, restrictions, bridge load limits and other limitations affecting transportation and ingress and egress at the job site. The unavailability of transportation facilities or limitations thereon shall not become a basis for claims against the Government or extension of time for completion of the work.

52.236-5 MATERIAL AND WORKMANSHIP (APR 1984)

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent

rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

52.236-6 SUPERINTENDENCE BY THE CONTRACTOR (APR 1984)

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the worksite a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

52.236-7 PERMITS AND RESPONSIBILITIES (NOV 1991)

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

52.236-8 OTHER CONTRACTS (APR 1984)

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

52.236-9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984)

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities

(1) at or near the work site, and

(2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

52.236-10 OPERATIONS AND STORAGE AREAS (APR 1984)

(a) The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

(b) Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

52.236-11 USE AND POSSESSION PRIOR TO COMPLETION (APR 1984)

(a) The Government shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the Government has such possession or use, the Contractor shall be

relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

52.236-12 CLEANING UP (APR 1984)

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

52.236-13 ACCIDENT PREVENTION (NOV 1991) - ALTERNATE I (NOV 1991)

(a) The Contractor shall provide and maintain work environments and procedures which will

(1) safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities;

(2) avoid interruptions of Government operations and delays in project completion dates; and

(3) control costs in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall-

(1) Provide appropriate safety barricades, signs, and signal lights;

(2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and

(3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the Contractor or the Contractor's representative

at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(e) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

(f) Before commencing the work, the Contractor shall-

(1) Submit a written proposed plan for implementing this clause. The plan shall include an analysis of the significant hazards to life, limb, and property inherent in contract work performance and a plan for controlling these hazards; and

(2) Meet with representatives of the Contracting Officer to discuss and develop a mutual understanding relative to administration of the overall safety program.

52.236-15 SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984)

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately deliver three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the

contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

52.236-17 LAYOUT OF WORK (APR 1984)

The Contractor shall lay out its work from Government established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997) -
ALTERNATE I (APR 1984)

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean "approved by," or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown," as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place," that is "furnished and installed".

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and

assembly of structural elements, and (2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor. Upon completing the work under this contract, the Contractor shall furnish a complete set of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the equipment is completed and accepted.

52.236-26 PRECONSTRUCTION CONFERENCE (FEB 1995)

If the Contracting Officer decides to conduct a preconstruction conference, the successful offeror will be notified and will be required to attend. The Contracting Officer's notification will include specific details regarding the date, time, and location of the conference, any need for attendance by subcontractors, and information regarding the items to be discussed.

52.242-13 BANKRUPTCY (JUL 1995)

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification shall be furnished within

five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

(End of clause)

52.242-14 SUSPENSION OF WORK (APR 1984)

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract. (c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

52.243-4 CHANGES (AUG 1987)

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

- (1) In the specifications (including drawings and designs);
- (2) In the method or manner of performance of the work;
- (3) In the Government-furnished facilities, equipment, materials, services, or site; or
- (4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b),

includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating

(1) the date, circumstances, and source of the order and

(2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after

(1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

52.243-7 NOTIFICATION OF CHANGES (APR 1984)

(a) Definitions. "Contracting Officer," as used in this clause, does not include any representative of the Contracting Officer. "Specifically authorized representative (SAR)," as used in this clause, means any person the Contracting Officer has so designated by written notice (a copy of which shall be provided to the Contractor) which shall refer to this subparagraph and shall be issued to the designated representative before the SAR exercises such authority.

(b) Notice. The primary purpose of this clause is to obtain prompt reporting of Government conduct that the Contractor considers to constitute a change to this contract. Except for changes identified as such in writing and signed by the Contracting Officer, the Contractor shall notify the Administrative Contracting Officer in writing, within 14 calendar days from the date that the Contractor identifies any Government conduct (including actions, inactions, and written or oral communications) that the Contractor regards as a change to the contract terms and conditions. On the basis of the most accurate information available to the Contractor, the notice shall state--

(1) The date, nature, and circumstances of the conduct regarded as a change;

(2) The name, function, and activity of each Government individual and Contractor official or employee involved in or knowledgeable about such conduct;

(3) The identification of any documents and the substance of any oral communication involved in such conduct;

(4) In the instance of alleged acceleration of scheduled performance or delivery, the basis upon which it arose;

(5) The particular elements of contract performance for which the Contractor may seek an equitable adjustment under this clause, including--

- (i) What contract line items have been or may be affected by the alleged change;
 - (ii) What labor or materials or both have been or may be added, deleted, or wasted by the alleged change;
 - (iii) To the extent practicable, what delay and disruption in the manner and sequence of performance and effect on continued performance have been or may be caused by the alleged change;
 - (iv) What adjustments to contract price, delivery schedule, and other provisions affected by the alleged change are estimated; and
- (6) The Contractor's estimate of the time by which the Government must respond to the Contractor's notice to minimize cost, delay or disruption of performance.
- (c) Continued performance. Following submission of the notice required by (b) above, the Contractor shall diligently continue performance of this contract to the maximum extent possible in accordance with its terms and conditions as construed by the Contractor, unless the notice reports a direction of the Contracting Officer or a communication from a SAR of the Contracting Officer, in either of which events the Contractor shall continue performance; provided, however, that if the Contractor regards the direction or communication as a change as described in (b) above, notice shall be given in the manner provided. All directions, communications, interpretations, orders and similar actions of the SAR shall be reduced to writing and copies furnished to the Contractor and to the Contracting Officer. The Contracting Officer shall countermand any action which exceeds the authority of the SAR.
- (d) Government response. The Contracting Officer shall promptly, within 14 calendar days after receipt of notice, respond to the notice in writing. In responding, the Contracting Officer shall either--
- (1) Confirm that the conduct of which the Contractor gave notice constitutes a change and when necessary direct the mode of further performance;
 - (2) Countermand any communication regarded as a change;
 - (3) Deny that the conduct of which the Contractor gave notice constitutes a change and when necessary direct the mode of further performance; or
 - (4) In the event the Contractor's notice information is inadequate to make a decision under (1), (2), or (3) above, advise the Contractor what additional information is required, and establish the date by which it should be furnished and the date thereafter by which the Government will respond.
- (e) Equitable adjustments.
- (1) If the Contracting Officer confirms that Government conduct effected a change as alleged by the Contractor, and the conduct causes an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the work under this contract, whether changed or not changed by such conduct, an equitable adjustment shall be made--
 - (i) In the contract price or delivery schedule or both; and
 - (ii) In such other provisions of the contract as may be affected.
 - (2) The contract shall be modified in writing accordingly. In the case of drawings, designs or specifications which are defective and for which the Government is responsible, the equitable adjustment shall include the cost and time extension for delay reasonably incurred by the Contractor in attempting to comply with the defective drawings, designs or specifications before the Contractor identified, or reasonably should have identified, such defect. When the cost of property made obsolete or excess as a result of a change confirmed by the Contracting Officer under this

clause is included in the equitable adjustment, the Contracting Officer shall have the right to prescribe the manner of disposition of the property. The equitable adjustment shall not include increased costs or time extensions for delay resulting from the Contractor's failure to provide notice or to continue performance as provided, respectively, in (b) and (c) above.

52.244-2 SUBCONTRACTS (AUG 1998)

(a) Definitions. As used in this clause--

Approved purchasing system means a Contractor's purchasing system that has been reviewed and approved in accordance with Part 44 of the Federal Acquisition Regulation (FAR).

Consent to subcontract means the Contracting Officer's written consent for the Contractor to enter into a particular subcontract.

Subcontract means any contract, as defined in FAR Subpart 2.1, entered into by a subcontractor to furnish supplies or services for performance of the prime contract or a subcontract. It includes, but is not limited to, purchase orders, and changes and modifications to purchase orders.

(b) This clause does not apply to subcontracts for special test equipment when the contract contains the clause at FAR 52.245-18, Special Test Equipment.

(c) When this clause is included in a fixed-price type contract, consent to subcontract is required only on unpriced contract actions (including unpriced modifications or unpriced delivery orders), and only if required in accordance with paragraph (d) or (e) of this clause.

(d) If the Contractor does not have an approved purchasing system, consent to subcontract is required for any subcontract that--

(1) Is of the cost-reimbursement, time-and-materials, or labor-hour type; or

(2) Is fixed-price and exceeds--

(i) For a contract awarded by the Department of Defense, the Coast Guard, or the National Aeronautics and Space Administration, the greater of the simplified acquisition threshold or 5 percent of the total estimated cost of the contract; or

(ii) For a contract awarded by a civilian agency other than the Coast Guard and the National Aeronautics and Space Administration, either the simplified acquisition threshold or 5 percent of the total estimated cost of the contract.

(e) If the Contractor has an approved purchasing system, the Contractor nevertheless shall obtain the Contracting Officer's written consent before placing the following subcontracts:

None

(f)(1) The Contractor shall notify the Contracting Officer reasonably in advance of placing any subcontract or modification thereof for which consent is required under paragraph (c), (d), or (e) of this clause, including the following information:

(i) A description of the supplies or services to be subcontracted.

(ii) Identification of the type of subcontract to be used.

(iii) Identification of the proposed subcontractor.

(iv) The proposed subcontract price.

(v) The subcontractor's current, complete, and accurate cost or pricing data and Certificate of Current Cost or Pricing Data, if required by other contract provisions.

(vi) The subcontractor's Disclosure Statement or Certificate relating to Cost Accounting Standards when such data are required by other provisions of this contract.

(vii) A negotiation memorandum reflecting--

(A) The principal elements of the subcontract price negotiations;

(B) The most significant considerations controlling establishment of initial or revised prices;

(C) The reason cost or pricing data were or were not required;

(D) The extent, if any, to which the Contractor did not rely on the subcontractor's cost or pricing data in determining the price objective and in negotiating the final price;

(E) The extent to which it was recognized in the negotiation that the subcontractor's cost or pricing data were not accurate, complete, or current; the action taken by the Contractor and the subcontractor; and the effect of any such defective data on the total price negotiated;

(F) The reasons for any significant difference between the Contractor's price objective and the price negotiated; and

(G) A complete explanation of the incentive fee or profit plan when incentives are used. The explanation shall identify each critical performance element, management decisions used to quantify each incentive element, reasons for the incentives, and a summary of all trade-off possibilities considered.

(2) The Contractor is not required to notify the Contracting Officer in advance of entering into any subcontract for which consent is not required under paragraph (c), (d), or (e) of this clause.

(g) Unless the consent or approval specifically provides otherwise, neither consent by the Contracting Officer to any subcontract nor approval of the Contractor's purchasing system shall constitute a determination--

(1) Of the acceptability of any subcontract terms or conditions;

(2) Of the allowability of any cost under this contract; or

(3) To relieve the Contractor of any responsibility for performing this contract.

(h) No subcontract or modification thereof placed under this contract shall provide for payment on a cost-plus-a-percentage-of-cost basis, and any fee payable under cost-reimbursement type subcontracts shall not exceed the fee limitations in FAR 15.404-4(c)(4)(i).

(i) The Contractor shall give the Contracting Officer immediate written notice of any action or suit filed and prompt notice of any claim made against the Contractor by any subcontractor or vendor that, in the opinion of the Contractor, may result in litigation related in any way to this contract, with respect to which the Contractor may be entitled to reimbursement from the Government.

(j) The Government reserves the right to review the Contractor's purchasing system as set forth in FAR Subpart 44.3.

(k) Paragraphs (d) and (f) of this clause do not apply to the following subcontracts, which were evaluated during negotiations:

None

(End of clause)

52.244-6 SUBCONTRACTS FOR COMMERCIAL ITEMS AND COMMERCIAL COMPONENTS (OCT 1998)

(a) Definitions.

"Commercial item", as used in this clause, has the meaning contained in the clause at 52.202-1, Definitions.

"Subcontract", as used in this clause, includes a transfer of commercial items between divisions, subsidiaries, or affiliates of the Contractor or subcontractor at any tier.

(b) To the maximum extent practicable, the Contractor shall incorporate, and require its subcontractors at all tiers to incorporate, commercial items or nondevelopmental items as components of items to be supplied under this contract.

(c) Notwithstanding any other clause of this contract, the Contractor is not required to include any FAR provision or clause, other than those listed below to the extent they are applicable and as may be required to establish the reasonableness of prices under Part 15, in a subcontract at any tier for commercial items or commercial components:

(1) 52.222-26, Equal Opportunity (E.O. 11246);

(2) 52.222-35, Affirmative Action for Disabled Veterans and Veterans of the Vietnam Era (38 U.S.C. 4212(a));

(3) 52.222-36, Affirmative Action for Workers with Disabilities (29 U.S.C. 793); and

(4) 52.247-64, Preference for Privately-Owned U.S.-Flagged Commercial Vessels (46 U.S.C. 1241)(flow down not required for subcontracts awarded beginning May 1, 1996).

(d) The Contractor shall include the terms of this clause, including this paragraph (d), in subcontracts awarded under this contract.

52.246-12 INSPECTION OF CONSTRUCTION (AUG 1996)

(a) Definition. "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not--

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;

(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;

(3) Constitute or imply acceptance; or

(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) of this section.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

52.246-21 WARRANTY OF CONSTRUCTION (MAR 1994)

(a) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (i) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

(b) This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(c) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished.

(d) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

(e) The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

(f) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(g) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

(h) In the event the Contractor's warranty under paragraph (b) of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(i) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

(j) This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

(End of clause)

52.248-3 VALUE ENGINEERING--CONSTRUCTION (FEB 2000)

(a) General. The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) below.

(b) Definitions. "Collateral costs," as used in this clause, means agency costs of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause, means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs, including subcontractors' development and implementation costs (see paragraph (h) below).

"Value engineering change proposal (VECP)" means a proposal that--

(1) Requires a change to this, the instant contract, to implement; and

(2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; provided, that it does not involve a change--

(i) In deliverable end item quantities only; or

(ii) To the contract type only.

(c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

(1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.

(2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.

(3) A separate, detailed cost estimate for

(i) the affected portions of the existing contract requirement and

(ii) the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) below.

(4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.

(5) A prediction of any effects the proposed change would have on collateral costs to the agency.

(6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.

(7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.

(d) Submission. The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

(e) Government action.

(1) The Contracting Officer will notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer will notify the Contractor within the 45-day period and provide the reason for the delay and the expected date of the decision. The Government will process VECP's expeditiously; however, it shall not be liable for any delay in acting upon a VECP.

If the VECP is not accepted, the Contracting Officer will notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The decision to accept or reject all or part of any VECP is a unilateral decision made solely at the discretion of the Contracting Officer.

(f) Sharing.

(1) Rates. The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by

(i) 45 percent for fixed-price contracts or

(ii) 75 percent for cost-reimbursement contracts.

(2) Payment. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

(i) Accept the VECP;

(ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and

(iii) Provide the Contractor's share of savings by adding the amount calculated to the contract price or fee.

(g) Collateral savings. If a VECP is accepted, the Contracting Officer will increase the instant contract amount by 20 percent of any projected collateral savings determined to be realized in a typical year of use after subtracting any Government costs not previously offset. However, the Contractor's share of collateral savings will not exceed the contract's firm-fixed-price or estimated cost, at the time the VECP is accepted, or \$100,000, whichever is greater. The Contracting Officer is the sole determiner of the amount of collateral savings.

(h) Subcontracts. The Contractor shall include an appropriate value engineering clause in any subcontract of \$50,000 or more and may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; provided, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(i) Data. The Contractor may restrict the Government's right to use any part of a VECP or the supporting data by marking the following legend on the affected parts:

"These data, furnished under the Value Engineering-- Construction clause of contract , shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations." If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract

modification implementing the VECP and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of clause)

52.249-2 TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (SEP 1996) -
ALTERNATE I (SEP 1996)

(a) The Government may terminate performance of work under this contract in whole or, from time to time, in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination, and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

(1) Stop work as specified in the notice.

(2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.

(3) Terminate all subcontracts to the extent they relate to the work terminated.

(4) Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle or to pay any termination settlement proposal arising out of those terminations.

(5) With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.

(6) As directed by the Contracting Officer, transfer title and deliver to the Government (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Government.

(7) Complete performance of the work not terminated.

(8) Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.

(9) Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in subparagraph (b)(6) of this clause; provided, however, that the Contractor (i) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.

(c) The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.

(d) After expiration of the plant clearance period as defined in Subpart 45.6 of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.

(e) After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1-year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of information available, the amount, if any, due the Contractor because of the termination and shall pay the amount determined.

(f) Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid or remaining to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (g) or paragraph (g) of this clause, exclusive of costs shown in subparagraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be modified, and the Contractor paid the agreed amount. Paragraph (g) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(g) If the Contractor and Contracting Officer fail to agree on the whole amount to be paid the Contractor because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined as follows, but without duplication of any amounts agreed upon under paragraph (f) of this clause:

(1) For contract work performed before the effective date of termination, the total (without duplication of any items) of--

(i) The cost of this work;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(1)(i) of this clause; and

(iii) A sum, as profit on subdivision (g)(1)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(2) The reasonable costs of settlement of the work terminated, including--

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(h) Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the

fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.

(i) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.

(j) The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or (l) of this clause, except that if the Contractor failed to submit the termination settlement proposal or request for equitable adjustment within the time provided in paragraph (e) or (l), respectively, and failed to request a time extension, there is no right of appeal.

(k) In arriving at the amount due the Contractor under this clause, there shall be deducted--

(1) All unliquidated advance or other payments to the Contractor under the terminated portion of this contract;

(2) Any claim which the Government has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.

(l) If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Contracting Officer.

(m)(1) The Government may, under the terms and conditions it prescribes, make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.

(n) Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

52.249-10 DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984)

(a) If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time, the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the Government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time,

whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.

(b) The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if--

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include

(i) acts of God or of the public enemy,

(ii) acts of the Government in either its sovereign or contractual capacity,

(iii) acts of another Contractor in the performance of a contract with the Government,

(iv) fires,

(v) floods,

(vi) epidemics,

(vii) quarantine restrictions,

(viii) strikes,

(ix) freight embargoes,

(x) unusually severe weather, or delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

<http://www.arnet.gov/References/References.html>

52.252-4 ALTERATIONS IN CONTRACT (APR 1984)

Portions of this contract are altered as follows:

None

(End of clause)

52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (APR 1984)

- (a) The use in this solicitation or contract of any Federal Acquisition Regulation (48 CFR Chapter 1) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the clause.
- (b) The use in this solicitation or contract of any Department of Defense FAR Supplement (48 CFR Chapter 2) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

52.253-1 COMPUTER GENERATED FORMS (JAN 1991)

- (a) Any data required to be submitted on a Standard or Optional Form prescribed by the Federal Acquisition Regulation (FAR) may be submitted on a computer generated version of the form, provided there is no change to the name, content, or sequence of the data elements on the form, and provided the form carries the Standard or Optional Form number and edition date.
- (b) Unless prohibited by agency regulations, any data required to be submitted on an agency unique form prescribed by an agency supplement to the FAR may be submitted on a computer generated version of the form provided there is no change to the name, content, or sequence of the data elements on the form and provided the form carries the agency form number and edition date.
- (c) If the Contractor submits a computer generated version of a form that is different than the required form, then the rights and obligations of the parties will be determined based on the content of the required form.

252.201-7000 CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991)

- (a) "Definition. Contracting officer's representative" means an individual designated in accordance with subsection 201.602-2 of the Defense Federal Acquisition Regulation Supplement and authorized in writing by the contracting officer to perform specific technical or administrative functions.
- (b) If the Contracting Officer designates a contracting officer's representative (COR), the Contractor will receive a copy of the written designation. It will specify the extent of the COR's authority to act on behalf of the contracting officer. The COR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract.

(End of clause)

252.203-7001 PROHIBITION ON PERSONS CONVICTED OF FRAUD OR OTHER DEFENSE-CONTRACT-RELATED FELONIES (MAR 1999)

- (a) Definitions. As used in this clause—
 - (1) "Arising out of a contract with the DoD" means any act in connection with—
 - (i) Attempting to obtain;
 - (ii) Obtaining, or

(iii) Performing a contract or first-tier subcontract of any agency, department, or component of the Department of Defense (DoD).

(2) "Conviction of fraud or any other felony" means any conviction for fraud or a felony in violation of state or Federal criminal statutes, whether entered on a verdict or plea, including a plea of *nolo contendere*, for which sentence has been imposed.

(3) "Date of conviction" means the date judgment was entered against the individual.

(b) Any individual who is convicted after September 29, 1988, of fraud or any other felony arising out of a contract with the DoD is prohibited from serving--

(1) In a management or supervisory capacity on any DoD contract or first-tier subcontract;

(2) On the board of directors of any DoD contractor or first-tier subcontractor;

(3) As a consultant, agent, or representative for any DoD contractor or first-tier subcontractor; or

(4) In any other capacity with the authority to influence, advise, or control the decisions of any DoD contractor or subcontractor with regard to any DoD contract or first-tier subcontract.

(c) Unless waived, the prohibition in paragraph (b) of this clause applies for not less than 5 years from the date of conviction.

(d) 10 U.S.C. 2408 provides that a defense contractor or first-tier subcontractor shall be subject to a criminal penalty of not more than \$500,000 if convicted of knowingly—

(1) Employing a person under a prohibition specified in paragraph (b) of this clause; or

(2) Allowing such a person to serve on the board of directors of the contractor or first-tier subcontractor.

(e) In addition to the criminal penalties contained in 10 U.S.C. 2408, the Government may consider other available remedies, such as—

(1) Suspension or debarment;

(2) Cancellation of the contract at no cost to the Government; or

(3) Termination of the contract for default.

(f) The Contractor may submit written requests for waiver of the prohibition in paragraph (b) of this clause to the Contracting Officer. Requests shall clearly identify—

(1) The person involved;

(2) The nature of the conviction and resultant sentence or punishment imposed;

(3) The reasons for the requested waiver; and

(4) An explanation of why a waiver is in the interest of national security.

(g) The Contractor agrees to include the substance of this clause, appropriately modified to reflect the identity and relationship of the parties, in all first-tier subcontracts exceeding the simplified acquisition threshold in Part 2 of the Federal Acquisition Regulation, except those for commercial items or components.

(h) Pursuant to 10 U.S.C. 2408(c), defense contractors and subcontractors may obtain information as to whether a particular person has been convicted of fraud or any other felony arising out of a contract with the DoD by contacting The Office of Justice Programs, The Denial of Federal Benefits Office, U.S. Department of Justice, telephone (202) 616-3507.

(End of clause)

252.204-7003 CONTROL OF GOVERNMENT PERSONNEL WORK PRODUCT (APR 1992)

The Contractor's procedures for protecting against unauthorized disclosure of information shall not require Department of Defense employees or members of the Armed Forces to relinquish control of their work products, whether classified or not, to the contractor.

(End of clause)

252.204-7004 REQUIRED CENTRAL CONTRACTOR REGISTRATION.(MAR 2000)

(a) Definitions.

As used in this clause--

(1) Central Contractor Registration (CCR) database means the primary DoD repository for contractor information required for the conduct of business with DoD.

(2) Data Universal Numbering System (DUNS) number means the 9-digit number assigned by Dun and Bradstreet Information Services to identify unique business entities.

(3) Data Universal Numbering System +4 (DUNS+4) number means the DUNS number assigned by Dun and Bradstreet plus a 4-digit suffix that may be assigned by a parent (controlling) business concern. This 4-digit suffix may be assigned at the discretion of the parent business concern for such purposes as identifying subunits or affiliates of the parent business concern.

(4) Registered in the CCR database means that all mandatory information, including the DUNS number or the DUNS+4 number, if applicable, and the corresponding Commercial and Government Entity (CAGE) code, is in the CCR database; the DUNS number and the CAGE code have been validated; and all edits have been successfully completed.

(b)(1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee must be registered in the CCR database prior to award, during performance, and through final payment of any contract resulting from this solicitation, except for awards to foreign vendors for work to be performed outside the United States.

(2) The offeror shall provide its DUNS or, if applicable, its DUNS+4 number with its offer, which will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(3) Lack of registration in the CCR database will make an offeror ineligible for award.

(4) DoD has established a goal of registering an applicant in the CCR database within 48 hours after receipt of a complete and accurate application via the Internet. However, registration of an applicant submitting an application through a method other than the Internet may take up to 30 days. Therefore, offerors that are not registered should consider applying for registration immediately upon receipt of this solicitation.

(c) The Contractor is responsible for the accuracy and completeness of the data within the CCR, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after the initial registration, the Contractor is required to confirm on an annual basis that its information in the CCR database is accurate and complete.

(d) Offerors and contractors may obtain information on registration and annual confirmation requirements by calling 1-888-227-2423, or via the Internet at <http://www.ccr2000.com>.

(End of clause)

252.205-7000 PROVISION OF INFORMATION TO COOPERATIVE AGREEMENT HOLDERS (DEC 1991)

(a) Definition.

"Cooperative agreement holder" means a State or local government; a private, nonprofit organization; a tribal organization (as defined in section 4(c) of the Indian Self-Determination and Education Assistance Act (Pub. L. 93-268; 25 U.S.C. 450 (c))); or an economic enterprise (as defined in section 3(e) of the Indian Financing Act of 1974 (Pub. L. 93-362; 25 U.S.C. 1452(e))) whether such economic enterprise is organized for profit or nonprofit purposes; which has an agreement with the Defense Logistics Agency to furnish procurement technical assistance to business entities.

(b) The Contractor shall provide cooperative agreement holders, upon their request, with a list of those appropriate employees or offices responsible for entering into subcontracts under defense contracts. The list shall include the business address, telephone number, and area of responsibility of each employee or office.

(c) The Contractor need not provide the listing to a particular cooperative agreement holder more frequently than once a year.

(End of clause)

252.209-7000 ACQUISITION FROM SUBCONTRACTORS SUBJECT TO ONSITE INSPECTION UNDER THE INTERMEDIATE-RANGE NUCLEAR FORCES (INF) TREATY (NOV 1995)

(a) The Contractor shall not deny consideration for a subcontract award under this contract to a potential subcontractor subject to on-site inspection under the INF Treaty, or a similar treaty, solely or in part because of the actual or potential presence of Soviet inspectors at the subcontractor's facility, unless the decision is approved by the Contracting Officer.

(b) The Contractor shall incorporate this clause, including this paragraph (b), in all solicitations and contracts exceeding the simplified acquisition threshold in part 13 of the Federal Acquisition Regulation, except those for commercial items.

252.209-7003 COMPLIANCE WITH VETERANS' EMPLOYMENT REPORTING REQUIREMENTS (MAR 1998)

By submission of its offer, the offeror represents that, if it is subject to the reporting requirements of 37 U.S.C. 4212(d) (i.e., the VETS-100 report required by Federal Acquisition Regulation clause 52.222-37, Employment Reports on Disabled Veterans and Veterans of the Vietnam Era), it has submitted the most recent report required by 38 U.S.C. 4212(d).

252.209-7004 SUBCONTRACTING WITH FIRMS THAT ARE OWNED OR CONTROLLED BY THE GOVERNMENT OF A TERRORIST COUNTRY (MAR 1998)

(a) Unless the Government determines that there is a compelling reason to do so, the Contractor shall not enter into any subcontract in excess of \$25,000 with a firm, or subsidiary of a firm, that is identified, on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs, as being ineligible for the award of Defense contracts or subcontracts because it is owned or controlled by the government of a terrorist country.

(b) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is identified, on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs, as being ineligible for the award of Defense contracts or subcontracts because it is owned or controlled by the government of a terrorist country. The notice must include the name of the proposed subcontractor notwithstanding its inclusion on the List of Parties Excluded From Federal Procurement and Nonprocurement Programs.

252.219-7009 SECTION 8(A) DIRECT AWARD (JUN 1998)

(a) This contract is issued as a direct award between the contracting office and the 8(a) Contractor pursuant to the Memorandum of Understanding dated May 6, 1998, between the Small Business Administration (SBA) and the Department of Defense. Accordingly, the SBA is not a party to this contract. SBA does retain responsibility for 8(a) certification, for 8(a) eligibility determinations and related issues, and for providing counseling and assistance to the 8(a) Contractor under the 8(a) Program. The cognizant SBA district office is:

[To be completed by the Contracting Officer at the time of award]

(b) The contracting office is responsible for administering the contract and for taking any action on behalf of the Government under the terms and conditions of the contract; provided that the contracting office shall give advance notice to the SBA before it issues a final notice terminating performance, either in whole or in part, under the contract. The contracting office also shall coordinate with the SBA prior to processing any novation agreement. The contracting office may assign contract administration functions to a contract administration office.

(c) The Contractor agrees that--

(1) It will notify the Contracting Officer, simultaneous with its notification to the SBA (as required by SBA's 8(a) regulations at 13 CFR 124.308), when the owner or owners upon whom 8(a) eligibility is based plan to relinquish ownership or control of the concern. Consistent with Section 407 of Pub. L. 100-656, transfer of ownership or control shall result in termination of the contract for convenience, unless the SBA waives the requirement for termination prior to the actual relinquishing of ownership and control; and

(2) It will not subcontract the performance of any of the requirements of this contract without the prior written approval of the SBA and the Contracting Officer.

(End of Clause)

252.223-7004 DRUG-FREE WORK FORCE (SEP 1988)

(a) Definitions.

(1) "Employee in a sensitive position," as used in this clause, means an employee who has been granted access to classified information; or employees in other positions that the Contractor determines involve national security; health or safety, or functions other than the foregoing requiring a high degree of trust and confidence.

(2) "Illegal drugs," as used in this clause, means controlled substances included in Schedules I and II, as defined by section 802(6) of title 21 of the United States Code, the possession of which is unlawful under chapter 13 of that Title. The term "illegal drugs" does not mean the use of a controlled substance pursuant to a valid prescription or other uses authorized by law.

(b) The Contractor agrees to institute and maintain a program for achieving the objective of a drug-free work force. While this clause defines criteria for such a program, contractors are encouraged to implement alternative approaches comparable to the criteria in paragraph (c) that are designed to achieve the objectives of this clause.

(c) Contractor programs shall include the following, or appropriate alternatives:

(1) Employee assistance programs emphasizing high level direction, education, counseling, rehabilitation, and coordination with available community resources;

(2) Supervisory training to assist in identifying and addressing illegal drug use by Contractor employees;

(3) Provision for self-referrals as well as supervisory referrals to treatment with maximum respect for individual confidentiality consistent with safety and security issues;

(4) Provision for identifying illegal drug users, including testing on a controlled and carefully monitored basis. Employee drug testing programs shall be established taking account of the following:

(i) The Contractor shall establish a program that provides for testing for the use of illegal drugs by employees in sensitive positions. The extent of and criteria for such testing shall be determined by the Contractor based on considerations that include the nature of the work being performed under the contract, the employee's duties, and efficient use of Contractor resources, and the risks to health, safety, or national security that could result from the failure of an employee adequately to discharge his or her position.

(ii) In addition, the Contractor may establish a program for employee drug testing--

(A) When there is a reasonable suspicion that an employee uses illegal drugs; or

(B) When an employee has been involved in an accident or unsafe practice;

(C) As part of or as a follow-up to counseling or rehabilitation for illegal drug use;

(D) As part of a voluntary employee drug testing program.

(iii) The Contractor may establish a program to test applicants for employment for illegal drug use.

(iv) For the purpose of administering this clause, testing for illegal drugs may be limited to those substances for which testing is prescribed by section 2.1 of subpart B of the "Mandatory Guidelines for Federal Workplace Drug Testing Programs" (53 FR 11980 (April 11, 1988), issued by the Department of Health and Human Services.

(d) Contractors shall adopt appropriate personnel procedures to deal with employees who are found to be using drugs illegally. Contractors shall not allow any employee to remain on duty or perform in a sensitive position who is found to use illegal drugs until such times as the Contractor, in accordance with procedures established by the Contractor, determines that the employee may perform in such a position.

(e) The provisions of this clause pertaining to drug testing program shall not apply to the extent that are inconsistent with state or local law, or with an existing collective bargaining agreement; provided that with respect to the latter, the Contractor agrees those issues that are in conflict will be a subject of negotiation at the next collective bargaining session.

(End of clause)

252.223-7006 PROHIBITION ON STORAGE AND DISPOSAL OF TOXIC AND HAZARDOUS MATERIALS (APR 1993)

(a) "Definitions".

As used in this clause --

(1) "Storage" means a non-transitory, semi-permanent or permanent holding, placement, or leaving of material. It does not include a temporary accumulation of a limited quantity of a material used in or a waste generated or resulting from authorized activities, such as servicing, maintenance, or repair of Department of Defense (DoD) items, equipment, or facilities.

(2) "Toxic or hazardous materials" means:

(i) Materials referred to in section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. 9601(14)) and materials designated under section 102 of CERCLA (42 U.S.C. 9602) (40 CFR part 302);

(ii) Materials that are of an explosive, flammable, or pyrotechnic nature; or

(iii) Materials otherwise identified by the Secretary of Defense as specified in DoD regulations.

(b) In accordance with 10 U.S.C. 2692, the Contractor is prohibited from storing or disposing of non-DoD-owned toxic or hazardous materials on a DoD installation, except to the extent authorized by a statutory exception to 10 U.S.C. 2692 or as authorized by the Secretary of Defense or his designee.

(End of clause)

252.225-7012 PREFERENCE FOR CERTAIN DOMESTIC COMMODITIES (AUG 2000)

(a) The Contractor agrees to deliver under this contract only such of the following articles that have been grown, reprocessed, reused, or produced in the United States, its possessions, or Puerto Rico --

(1) Food;

(2) Clothing;

(3) Tents, tarpaulins, or covers;

(4) Cotton and other natural fiber products;

(5) Woven silk or woven silk blends;

(6) Spun silk yarn for cartridge cloth;

(7) Synthetic fabric, and coated synthetic fabric, including all textile fibers and yarns that are for use in such fabrics;

(8) Canvas products;

(9) Wool (whether in the form of fiber or yarn or contained in fabrics, materials, or manufactured articles); or

(10) Any item of individual equipment (Federal supply Classification 8465) manufactured from or containing such fibers, yarns, fabrics, or materials.

(b) This clause does not apply --

- (1) To supplies listed in FAR section 25.104(a), or other supplies for which the Government has determined that a satisfactory quality and sufficient quantity cannot be acquired as and when needed at U.S. market prices;
- (2) To foods which have been manufactured or processed in the United States, its possessions, or Puerto Rico;
- (3) To chemical warfare protective clothing produced in the countries listed in subsection 225.872-1 of the Defense FAR Supplement; or
- (4) To fibers and yarns that are for use in synthetic fabric or coated synthetic fabric (but does apply to the synthetic or coated synthetic fabric itself), if--
 - (i) The fabric is to be used as a component of an end item that is not a textile product. Examples of textile products, made in whole or in part of fabric, include--
 - (a) Draperies, floor coverings, furnishings, and bedding (Federal Supply Group 72, Household and Commercial Furnishings and Appliances);
 - (B) Items made in whole or in part of fabric in Federal Supply Group 83, Textile/leather/furs/apparel/findings/tents/flags, or Federal Supply Group 84, Clothing, Individual Equipment and Insignia;
 - (C) Upholstered seats (whether for household, office, or other use); and
 - (D) Parachutes (Federal Supply Class 1670); or
 - (ii) The fibers and yarns are para-aramid fibers and yarns manufactured in the Netherlands.

(End of clause)

252.225-7031 SECONDARY ARAB BOYCOTT OF ISRAEL (JUN 1992)

(a) Definitions. As used in this clause--

- (1) "Foreign person" means any person other than a United States person as defined in Section 16(2) of the Export Administration Act of 1979 (50 U.S.C. App. Sec 2415).
- (2) "United States person" is defined in Section 16(2) of the Export Administration Act of 1979 and means any United States resident or national (other than an individual resident outside the United States and employed by other than a United States person), any domestic concern (including any permanent domestic establishment of any foreign concern), and any foreign subsidiary or affiliate (including any permanent foreign establishment) of any domestic concern which is controlled in fact by such domestic concerns, as determined under regulations of the President.

(b) Certification. By submitting this offer, the Offeror, if a foreign person, company or entity, certifies that it--

- (1) Does not comply with the Secondary Arab Boycott of Israel; and
- (2) Is not taking or knowingly agreeing to take any action, with respect to the Secondary Boycott of Israel by Arab countries, which 50 U.S.C. App. Sec 2407(a) prohibits a United States person from taking.

(End of clause)

252.227-7033 RIGHTS IN SHOP DRAWINGS (APR 1966)

(a) Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower-tier subcontractor pursuant to a construction contract, showing in detail (i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(b) This clause, including this paragraph (b), shall be included in all subcontracts hereunder at any tier.

252.231-7000 SUPPLEMENTAL COST PRINCIPLES (DEC 1991)

When the allowability of costs under this contract is determined in accordance with part 31 of the Federal Acquisition Regulation (FAR), allowability shall also be determined in accordance with part 231 of the Defense FAR Supplement, in effect on the date of this contract.

252.236-7000 MODIFICATION PROPOSALS - PRICE BREAKDOWN. (DEC 1991)

(a) The Contractor shall furnish a price breakdown, itemized as required and within the time specified by the Contracting Officer, with any proposal for a contract modification.

(b) The price breakdown --

(1) Must include sufficient detail to permit an analysis of profit, and of all costs for --

(i) Material;

(ii) Labor;

(iii) Equipment;

(iv) Subcontracts; and

(v) Overhead; and

(2) Must cover all work involved in the modification, whether the work was deleted, added, or changed.

(c) The Contractor shall provide similar price breakdowns to support any amounts claimed for subcontracts.

(d) The Contractor's proposal shall include a justification for any time extension proposed.

252.236-7001 CONTRACT DRAWINGS, MAPS, AND SPECIFICATIONS (AUG 2000)

(a) The Government will provide to the Contractor, without charge, one set of contract drawings and specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer.

(b) The Contractor shall--

(1) Check all drawings furnished immediately upon receipt;

(2) Compare all drawings and verify the figures before laying out the work;

(3) Promptly notify the Contracting Officer of any discrepancies;

(4) Be responsible for any errors that might have been avoided by complying with this paragraph (b); and

(5) Reproduce and print contract drawings and specifications as needed.

(c) In general--

(1) Large-scale drawings shall govern small-scale drawings; and

(2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work that are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified in the attachments:

(End of clause)

252.242-7000 POSTAWARD CONFERENCE (DEC 1991)

The Contractor agrees to attend any postaward conference convened by the contracting activity or contract administration office in accordance with Federal Acquisition Regulation subpart 42.5.

(End of clause)

252.243-7001 PRICING OF CONTRACT MODIFICATIONS (DEC 1991)

When costs are a factor in any price adjustment under this contract, the contract cost principles and procedures in FAR part 31 and DFARS part 231, in effect on the date of this contract, apply.

252.243-7002 REQUESTS FOR EQUITABLE ADJUSTMENT (MAR 1998)

(a) The amount of any request for equitable adjustment to contract terms shall accurately reflect the contract adjustment for which the Contractor believes the Government is liable. The request shall include only costs for performing the change, and shall not include any costs that already have been reimbursed or that have been separately claimed. All indirect costs included in the request shall be properly allocable to the change in accordance with applicable acquisition regulations.

(b) In accordance with 10 U.S.C. 2410(a), any request for equitable adjustment to contract terms that exceeds the simplified acquisition threshold shall bear, at the time of submission, the following certificate executed by an individual authorized to certify the request on behalf of the Contractor:

I certify that the request is made in good faith, and that the supporting data are accurate and complete to the best of my knowledge and belief.

(Official's Name)

(Title)

(c) The certification in paragraph (b) of this clause requires full disclosure of all relevant facts, including--

- (1) Cost or pricing data if required in accordance with subsection 15.403-4 of the Federal Acquisition Regulation (FAR); and
- (2) Information other than cost or pricing data, in accordance with subsection 15.403-3 of the FAR, including actual cost data and data to support any estimated costs, even if cost or pricing data are not required.
- (d) The certification requirement in paragraph (b) of this clause does not apply to---
 - (1) Requests for routine contract payments; for example, requests for payment for accepted supplies and services, routine vouchers under a cost-reimbursement type contract, or progress payment invoices; or
 - (2) Final adjustment under an incentive provision of the contract.

252.247-7023 TRANSPORTATION OF SUPPLIES BY SEA (MAR 2000)

(a) Definitions. As used in this clause --

- (1) "Components" means articles, materials, and supplies incorporated directly into end products at any level of manufacture, fabrication, or assembly by the Contractor or any subcontractor.
- (2) "Department of Defense" (DoD) means the Army, Navy, Air Force, Marine Corps, and defense agencies.
- (3) "Foreign flag vessel" means any vessel that is not a U.S.-flag vessel.
- (4) "Ocean transportation" means any transportation aboard a ship, vessel, boat, barge, or ferry through international waters.
- (5) "Subcontractor" means a supplier, materialman, distributor, or vendor at any level below the prime contractor whose contractual obligation to perform results from, or is conditioned upon, award of the prime contract and who is performing any part of the work or other requirement of the prime contract.
- (6) "Supplies" means all property, except land and interests in land, that is clearly identifiable for eventual use by or owned by the DoD at the time of transportation by sea.
 - (i) An item is clearly identifiable for eventual use by the DoD if, for example, the contract documentation contains a reference to a DoD contract number or a military destination.
 - (ii) "Supplies" includes (but is not limited to) public works; buildings and facilities; ships; floating equipment and vessels of every character, type, and description, with parts, subassemblies, accessories, and equipment; machine tools; material; equipment; stores of all kinds; end items; construction materials; and components of the foregoing.
- (7) "U.S.-flag vessel" means a vessel of the United States or belonging to the United States, including any vessel registered or having national status under the laws of the United States.
- (b)(1) The Contractor shall use U.S.-flag vessels when transporting any supplies by sea under this contract.
- (2) A subcontractor transporting supplies by sea under this contract shall use U.S.-flag vessels if--
 - (i) This contract is a construction contract; or
 - (ii) The supplies being transported are--
 - (A) Noncommercial items; or
 - (B) Commercial items that--

(1) The Contractor is reselling or distributing to the Government without adding value (generally, the Contractor does not add value to items that it contracts for f.o.b. destination shipment);

(2) Are shipped in direct support of U.S. military contingency operations, exercises, or forces deployed in humanitarian or peacekeeping operations; or

(3) Are commissary or exchange cargoes transported outside of the Defense Transportation System in accordance with 10 U.S.C. 2643.

(c) The Contractor and its subcontractors may request that the Contracting Officer authorize shipment in foreign-flag vessels, or designate available U.S.-flag vessels, if the Contractor or a subcontractor believes that --

(1) U.S.-flag vessels are not available for timely shipment;

(2) The freight charges are inordinately excessive or unreasonable; or

(3) Freight charges are higher than charges to private persons for transportation of like goods.

(d) The Contractor must submit any request for use of other than U.S.-flag vessels in writing to the Contracting Officer at least 45 days prior to the sailing date necessary to meet its delivery schedules. The Contracting Officer will process requests submitted after such date(s) as expeditiously as possible, but the Contracting Officer's failure to grant approvals to meet the shipper's sailing date will not of itself constitute a compensable delay under this or any other clause of this contract. Requests shall contain at a minimum --

(1) Type, weight, and cube of cargo;

(2) Required shipping date;

(3) Special handling and discharge requirements;

(4) Loading and discharge points;

(5) Name of shipper and consignee;

(6) Prime contract number; and

(7) A documented description of efforts made to secure U.S.-flag vessels, including points of contact (with names and telephone numbers) with at least two U.S.-flag carriers contacted. Copies of telephone notes, telegraphic and facsimile message or letters will be sufficient for this purpose.

(e) The Contractor shall, within 30 days after each shipment covered by this clause, provide the Contracting Officer and the Division of National Cargo, Office of Market Development, Maritime Administration, U.S. Department of Transportation, Washington, DC 20590, one copy of the rated on board vessel operating carrier's ocean bill of lading, which shall contain the following information --

(1) Prime contract number;

(2) Name of vessel;

(3) Vessel flag of registry;

(4) Date of loading;

(5) Port of loading;

(6) Port of final discharge;

(7) Description of commodity;

(8) Gross weight in pounds and cubic feet if available;

(9) Total ocean freight in U.S. dollars; and

(10) Name of the steamship company.

(f) The Contractor agrees to provide with its final invoice under this contract a representation that to the best of its knowledge and belief --

(1) No ocean transportation was used in the performance of this contract;

(2) Ocean transportation was used and only U.S.-flag vessels were used for all ocean shipments under the contract;

(3) Ocean transportation was used, and the Contractor had the written consent of the Contracting Officer for all non-U.S.-flag ocean transportation; or

(4) Ocean transportation was used and some or all of the shipments were made on non-U.S.-flag vessels without the written consent of the Contracting Officer. The Contractor shall describe these shipments in the following format:

ITEM DESCRIPTION	CONTRACT LINE ITEMS	QUANTITY
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
TOTAL_____		

(g) If the final invoice does not include the required representation, the Government will reject and return it to the Contractor as an improper invoice for the purposes of the Prompt Payment clause of this contract. In the event there has been unauthorized use of non-U.S.-flag vessels in the performance of this contract, the Contracting Officer is entitled to equitably adjust the contract, based on the unauthorized use.

(h) The Contractor shall include this clause, including this paragraph (h), in all subcontractors under this contract that--

(1) Exceed the simplified acquisition threshold in Part 2 of the Federal Acquisition Regulation; and

(2) Are for a type of supplies described in paragraph (b)(3) of this clause.

(End of clause)

252.247-7024 NOTIFICATION OF TRANSPORTATION OF SUPPLIES BY SEA (MAR 2000)

(a) The Contractor has indicated by the response to the solicitation provision, Representation of Extent of Transportation by Sea, that it did not anticipate transporting by sea any supplies. If, however, after the award of this contract, the Contractor learns that supplies, as defined in the Transportation of Supplies by Sea clause of this contract, will be transported by sea, the Contractor --

(1) Shall notify the Contracting Officer of that fact; and

(2) Hereby agrees to comply with all the terms and conditions of the Transportation of Supplies by Sea clause of this contract.

(b) The Contractor shall include this clause; including this paragraph (b), revised as necessary to reflect the relationship of the contracting parties--

(1) In all subcontracts under this contract, if this contract is a construction contract; or

(2) If this contract is not a construction contract, in all subcontracts under this contract that are for--

(i) Noncommercial items; or

(ii) Commercial items that--

(A) The Contractor is reselling or distributing to the Government without adding value (generally, the Contractor does not add value to items that it subcontracts for f.o.b. destination shipment);

(B) Are shipped in direct support of U.S. military contingency operations, exercises, or forces deployed in humanitarian or peacekeeping operations; or

(C) Are commissary or exchange cargoes transported outside of the Defense Transportation System in accordance with 10 U.S.C. 2643.

(End of clause)

SECTION 00800 Special Contract Requirements

52.231-5000 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995)–EFARS

(a) This statement shall become operative only for negotiated contracts where cost or pricing data is requested, and for modifications to sealed bid or negotiated contracts where cost or pricing data is requested. This clause does not apply to terminations. See 52.249-5000, Basis for Settlement of Proposals, and FAR Part 49.

(b) Allowable cost for CONSTRUCTION and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, CONSTRUCTION Equipment Ownership and Operating Expense Schedule, Region VII. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time the work was performed shall apply.

(c) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

(d) When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet.

NOTE 1: EP 1110-1-8 is available on the Internet at the following location: <http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/ep.htm>.

NOTE 2: Standard Form 1411 is no longer a current form. The Contracting Officer may require submission of cost or pricing data in the format indicated in Table 15-2 of FAR 15.408, specify an alternative format, or permit submission in the contractor's format. Information other than cost or pricing data may be submitted in the contractor's own format unless the use of a specific format is prescribed elsewhere in this contract.

52.249-5000 BASIS FOR SETTLEMENT OF PROPOSALS (DEC 1995)

Actual costs will be used to determine equipment costs for a settlement proposal submitted on the total cost basis under FAR 49.206-2(b). In

evaluating a termination settlement proposal using the total cost basis, the following principles will be applied to determine allowable equipment costs:

(1) Actual costs for each piece of equipment or groups of similar serial or series equipment need not be available in the Contractor's accounting records to determine total actual equipment costs.

(2) If equipment costs have been allocated to a contract using predetermined rates, those charges will be adjusted to actual costs.

(3) Recorded job costs adjusted for unallowable expenses will be used to determine equipment operating expenses.

(4) Ownership costs (depreciation) will be determined using the Contractor's depreciation schedule (subject to the provisions of FAR 31.205-11).

(5) License, taxes, storage and insurance costs are normally recovered as an indirect expense and unless the Contractor charges these costs directly to contracts, they will be recovered through the indirect expense rate.

52.0211-4852 PERFORMANCE PERIOD (OCT 1992)

The Contractor shall complete the entire work ready for use not later than the number of calendar days after the date of receipt of Notice to Proceed as set out in the Completion Schedule below (calendar days are not to be added together):

Completion Schedule:

<u>Description</u>	<u>Calendar Days After Date of Receipt of Notice To Proceed</u>
(1) Abatement and Demolition Work Plans	10
(2) Construction of a Water Treatment Plant, with related work at both the new and existing sites, complete.	350 *

* NOTE; The above listed item is also referenced under Section 01510; Work Sequence & GFI, as 'mandatory' sequence of events, the contractor must consider. Many of these can be fast tracked, to expedite construction schedule delivery.

52.0211.4853 WORK DAYS AND HOURS (APR 1992)

The normal work days and hours for this project will be Monday through Friday, excluding federal holidays, from 7:00 a.m. to 3:30 p.m. Access to the work site may be restricted to these hours and days. Work during other than normal hours and days must be coordinated in advance with the Administrative Contracting Officer.

52.0215-4101 ALTERNATE STRUCTURED APPROACH TO WEIGHTED GUIDELINE METHOD FOR CONSTRUCTION CONTRACTS (EFARS 15.973-100) (MAY 1995)

The following alternate structured approach shall be used for all fixed-price construction contract actions.

<u>Factor</u>	<u>Rate</u>	<u>Weight</u>	<u>Value</u>
Degree of risk	20		
Relative difficulty of work	15		
Size of job	15		
Period of performance	15		
Contractor's investment	5		
Assistance by Government	5		
Subcontracting	25		
Total	100%		

Based on the circumstances of the procurement action, each of the above factors shall be weighted from .03 to .12 as indicated below. "Value shall be obtained by multiplying the rate by the weight. The Value column when totaled indicates the fair and reasonable profit percentage under the circumstances of the particular procurement. The profit percentage should be multiplied by the total contract costs, including general and administrative costs.

(1) Degree of risk. Where the work involves no risk or the degree of risk is very small, the weighting should be .03; as the degree of risk increases, the weighting should be increased up to a maximum of .12. Lump sum items shall generally have a higher weight than unit price items; other things to consider include the nature of the work and where it is to be performed. Consider the portion of the work to be done by subcontractors, amount and type of labor included in costs, whether the negotiation is before or after performance of the work, etc. Modifications settled before the fact have much greater risk than those settled after the fact. A weight of .03 is appropriate for after the fact equitable adjustments and/or settlements.

(2) Relative Difficulty of Work: If the work is difficult and complex, the weight should be .12 and should be proportionately reduced to .03 on the simplest of jobs. This factor is tied in to some extent with the degree of risk. Some other things to consider are the nature of the work, by whom it is to be done (i.e., subcontractors, consultants), what is the time schedule.

(3) Size of Job. Work of \$100,000 or less shall be weighted at .12. Work estimated between \$100,000 and \$5,000,000 shall be proportionately weighted from .12 to .05. Work from \$5,000,000 to \$10,000,000 shall be weighted at .04. Work in excess of \$10,000,000 shall be weighted at .03. It should be noted that control of fixed expenses generally improves with increased job magnitude.

(4) Period of Performance. Work not to exceed one month is to be proportionately weighted at .03. Work in excess of 24 months is to be weighted at .12. Durations between one month and 24 months are to be proportionately weighted between .03 and .12.

(5) Contractor's Investment. To be weighted from .03 to .12 on the basis of below average, average and above average. Things to consider include amount of subcontracting, Government-furnished property or data such

as surveys, soil tests, method of making progress payments, and any mobilization payment items.

(6) Assistance by Government. To be weighted from .12 to .03 on the basis of average to above average. Consider use of Government-owned property, equipment and facilities, and expediting assistance.

(7) Subcontracting. To be weighted inversely proportional to the amount of subcontracting. Where 80% or more of the work is to be subcontracted use .03. The weighting should be increased proportionately to .12 where all the work is performed by the contractor's own forces.

52.0219-4509 SUBCONTRACTING WITH SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESSES (OCT 1999)

Contractors are cautioned that failure of any Contractor to comply in good faith with the contract clauses pertaining to (1) Utilization of Small Business Concerns or (2) Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plans, when applicable, will be a material breach of contract. In order to assist contractors in developing a source list of small, small disadvantaged and/or women-owned small business concerns you are encouraged to contact your minority contractor associates, the local Minority Business Development Agency and the appropriate General Business Service Centers in your Standard Metropolitan Statistical Area. Contractors may obtain addresses of these sources from:

Write: US Army Engineer District, Sacramento
ATTN: Contracting Division, Deputy for Small Business
1325 J Street, 8th Floor
Sacramento, California 95814-2922

Or Contact: Ms. Michelle Stratton
Deputy for Small Business
Telephone: (916) 557-7641

52.0219-4811 SMALL BUSINESS ADMINISTRATION REQUIREMENT (JUL 1993)
(APPLICABLE IF 8(a) SET-ASIDE)

A copy of the acceptance document and a copy of the final payment document will be provided to the Small Business Administration (SBA).

52.0223-4803 HAZARDOUS MATERIALS DELIVERED UNDER THIS CONTRACT (MAY 1993)

(a) If any hazardous materials will be delivered under this contract (see Section 00600, FAR 52.223-3, and DFARS 252.223-7001), the Material Safety Data Sheets (MSDS) for locally purchased, nonstandard stock hazardous material will be submitted to the Corps of Engineers Contracting Officer or Contracting Officer's Representative. For all other materials, the MSDS will also be submitted to U.S. Army Environmental Hygiene Agency, ATTN: HSE-OI, Aberdeen Proving Grounds MD 21010.

(b) Hazardous material is defined in Federal Standard No. 313, sold by the General Services Administration Specifications Unit (3FBP-W), 7th & D Streets, SW, Washington DC 20407.

52.0228-4502 MINIMUM INSURANCE REQUIRED (MAY 1993)

The contract clause, FAR 52.228-5, applies to this contract even if the work or any portion of the work is not performed on a Government installation. In accordance with FAR 52.228-5 and FAR 28.307-2, the contractor shall procure and thereafter maintain during the entire period of this performance under this contract the following minimum insurance.

TYPE	AMOUNT
Worker's Compensation and Employer's Liability	Comply with Federal and State worker's comp and occupational disease statutes. Employer's liability of at least \$100,000
General Liability (Comprehensive)	Bodily injury liability of at least \$500,000 per occurrence.
Automobile Liability (Comprehensive): Bodily Injury & Property Damage	At least \$200,000 per person and \$500,000 per occurrence. At least \$20,000 per occurrence.
Longshoremen's and Harbor Worker's Compensation (When applicable by location of contract performance)	Coverage complying with applicable Federal statute (33 USC 901 et seq).

52.0232-4501 INVOICES (AUG 1991)

The Government shall pay the Contractor upon submission of proper invoices for supplies delivered and accepted or services rendered and accepted for the portion of work actually performed under this contract. Invoices will be submitted in quadruplicate to the address in Block 26, SF1442, which will be completed at time of award. Invoices shall be submitted on ENG Form 93 which will be provided to the Contractor by the Government

52.236-4001 AS-BUILT DRAWINGS (PROGRESS PAYMENT) (OCT 1998)

One-half of one percent of construction award money shall be withheld until the final as-built drawings and CADD files are accepted by the Government.

52.0236-4581 AVAILABILITY OF UTILITIES SERVICES (APR 1992)

All reasonably required amounts of water, electricity, and other utilities essential to contract performance will be made available to the

contractor at no cost to the contractor from existing systems, outlets and supplies. All temporary connections, outlets and distribution lines, as may be required, shall be installed, maintained and removed by the Contractor at Contractor's expense; removal shall be before final acceptance of the work by the Government. The Contractor shall carefully conserve any utilities furnished without charge.

52.0236-4801 SALVAGE AND SCRAP GOVERNMENT PROPERTY (OCT 1993)

(a) "Government property" means all property owned by or leased to the Government or acquired by the Government under the terms of the contract. It includes both Government-furnished property and contractor-acquired property.

(b) "Salvage" means Government property in possession of a contractor, including subcontractors, that, because of its worn, damaged, deteriorated, or incomplete condition or specialized nature, has no reasonable prospect of sale or use as serviceable property without major repairs, but has some value in excess of its scrap value.

(c) "Scrap" means Government personal property that has no value except for its basic material content.

(d) In accordance with FAR 45.505-8 the Contractor shall maintain records of all scrap and salvage generated from this contract. The Contractor's records shall contain the following information:

- (1) Contract Number
- (2) Description of salvageable items or classification (material content) of scrap
- (3) Quantity on hand

(e) The Contractor shall provide final accounting and disposition recommendations of all Government property not consumed in performing this contract or delivered to the Government including salvage and scrap. The Government will review the Contractor's records and shall cause correction if the Government disagrees with the classification of items as salvage or scrap. The Contractor shall dispose of the items as directed by the Contracting Officer. Items designated as scrap (agreed to by the Contracting Officer) shall be retained by the Contractor; its disposition shall be the responsibility of the Contractor. See Specification Section 01505, paragraph entitled "Scrap Material". Items designated as salvageable items (agreed to by the Contracting Officer) shall be turned over to the Government.

52.0236-4900 HARBOR MAINTENANCE FEE (SEP 1995)

Offerors or bidders contemplating use of U.S. ports in the performance of the contract are subject to paying a harbor maintenance fee on cargo. Federal law establishes an ad valorem port use fee on commercial cargo imported into or exported from various U.S. ports. The fee is 0.125 percent (.00125). Cargo to be used in performing work under contracts with the U.S. Government is not exempt from the fee, although certain exemptions do exist. Offerors and bidders are responsible for ensuring that the applicable fee and associated costs are taken into consideration in the preparation of their offer or bid. Failure to pay the harbor maintenance fee may result in assessment of penalties by the Customs Service.

The statute is at Title 26 U.S. Code sections 4461 and 4462. Department of Treasury Customs Service regulations implementing the statute, including a list of ports subject to the fee, are found at 19 CFR Section 24.24., Harbor Maintenance Fee. Additional information may be obtained from local U.S. Customs Service Offices or by writing to the Director, Budget Division, Office of Finance, Room 6328, U.S. Customs Service, 1301 Constitution Avenue, N.W., Washington, D.C. 20229.

General Decision Number CA010009

General Decision Number CA010009

Superseded General Decision No. CA000009

State: California

Construction Type:

BUILDING

DREDGING

HEAVY

HIGHWAY

County(ies):

ALPINE	MODOC	SISKIYOU
--------	-------	----------

AMADOR	NAPA	SOLANO
--------	------	--------

BUTTE	NEVADA	SONOMA
-------	--------	--------

COLUSA	PLACER	SUTTER
--------	--------	--------

EL DORADO	PLUMAS	TEHAMA
-----------	--------	--------

GLENN	SACRAMENTO	TRINITY
-------	------------	---------

LASSEN	SHASTA	YOLO
--------	--------	------

MARIN	SIERRA	YUBA
-------	--------	------

BUILDING CONSTRUCTION PROJECTS; DREDGING CONSTRUCTION PROJECTS

(does not include hopper dredge work); HEAVY CONSTRUCTION

PROJECTS (does not include water well drilling); AND HIGHWAY

CONSTRUCTION PROJECTS

AMADOR COUNTY:

BUILDING CONSTRUCTION:

See wage data group ID no. SUCA1002A, only.

Modification Number	Publication Date
---------------------	------------------

0	03/02/2001
---	------------

1	03/23/2001
---	------------

COUNTY(ies):

ALPINE	MODOC	SISKIYOU
AMADOR	NAPA	SOLANO
BUTTE	NEVADA	SONOMA
COLUSA	PLACER	SUTTER
EL DORADO	PLUMAS	TEHAMA
GLENN	SACRAMENTO	TRINITY
LASSEN	SHASTA	YOLO
MARIN	SIERRA	YUBA

ASBE0016A 08/01/2000

	Rates	Fringes
INSULATOR/ASBESTOS WORKER		
Includes the application of all insulating materials, protective coverings, coatings, and finishings to all types of mechanical systems	37.38	7.66

ASBE0016H 05/01/1999

	Rates	Fringes
MARIN AND NAPA COUNTIES:		
ASBESTOS REMOVAL WORKER/HAZARDOUS MATERIAL HANDLER		
Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems, whether they contain asbestos or not	22.01	4.28

ASBE0016I 05/01/1999

	Rates	Fringes
ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SOLANO, SONOMA, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES:		
ASBESTOS REMOVAL WORKER/HAZARDOUS MATERIAL HANDLER		
Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems, whether they contain asbestos or not	22.01	4.28

BOIL0092A 10/01/1999

	Rates	Fringes
BOILERMAKER	29.56	9.81
TUBE WELDER	31.06	9.81

BRCA0003B 08/01/1998

	Rates	Fringes
MARBLE FINISHER	21.12	4.97

BRCA0003E 07/01/1999

	Rates	Fringes
ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC,		

NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SUTTER,
TEHAMA, YOLO AND YUBA COUNTIES:

BRICKLAYER	24.45	7.05
------------	-------	------

FOOTNOTES:

Underground work such as tunnel work, sewer work, manholes, catch basins, sewer pipes and telephone conduit shall be paid \$5.00 per day above the regular wage.

In addition to the daily allowance specified in the preceding sentence, all employees working in direct contact with raw sewage shall receive an additional allowance of \$2.50 per day above the regular wage.

Fifty cents (\$0.50) per hour extra will be allowed for operating a saw or grinder, provided such work is for the major portion of the day.

A gunite nozzle person shall receive \$1.00 per hour above the journeyman wage rate.

On one or two-person light-duty swinging scaffolds, from and including the seventh floor to the sky, \$10.00 per day over and above the regular wage shall be paid. The floors shall be determined by the number on the elevator identity or floor identity.

BRCA0003F 07/01/1999

	Rates	Fringes
MARIN, NAPA, SISKIYOU, SOLANO, SONOMA AND TRINITY COUNTIES:		
BRICKLAYER	29.45	9.75

FOOTNOTES:

Underground work such as tunnel work, sewer work, manholes, catch basins, sewer pipes and telephone conduit: \$5.00 per day additional.

Additionally, for work in direct contact with raw sewage: \$2.50 per day additional.

Operating a saw or grinder: \$0.50 per hour additional.

Gunite nozzle person: \$1.00 per hour additional.

On one or two person light duty swinging scaffolds, from and including the seventh floor to the sky (floors to be determined by the number on the elevator identity or floor identity): \$10.00 per day additional.

BRCA0003P 07/01/1999

	Rates	Fringes
TERRAZZO WORKER	32.00	9.65
TERRAZZO FINISHER	22.47	5.00

BRCA0003S 04/01/2000

	Rates	Fringes
ALPINE, AMADOR COUNTIES:		
TILE SETTER	26.73	7.10
TILE FINISHER	15.71	5.87
NAPA, SISKIYOU, SOLANO, MARIN, and TRINITY COUNTIES:		
TILE SETTERS	29.43	7.10
TILE FINISHERS	15.71	5.87
SONOMA COUNTY:		
TILE SETTER	26.27	7.10
TILE FINISHER	15.66	4.92

BRCA0003X 08/01/1998		
	Rates	Fringes
ALPINE, AMADOR, MARIN, NAPA, SISKIYOU, SOLANO, SONOMA AND TRINITY COUNTIES:		
MARBLE SETTER	30.65	9.96
MARBLE FINISHER	21.67	5.52

BRCA0003Y 08/01/1998		
	Rates	Fringes
BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SUTTER, TEHAMA, YOLO AND YUBA COUNTIES:		
MARBLE SETTER	30.65	9.96
MARBLE FINISHER	21.67	5.52

BRCA0029A 04/02/1993		
	Rates	Fringes
BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA, PLACER, PLUMAS SACRAMENTO, SHASTA, SIERRA, SUTTER,TEHAMA, YOLO,AND YUBA COUNTIES		
TILE SETTER	24.98	5.03
TILE FINISHER	15.00	2.40

CARP0003L 08/01/2000		
	Rates	Fringes
MARIN, NAPA, SOLANO AND SONOMA COUNTIES:		
DRYWALL INSTALLER/LATHER	28.00	11.645
DRYWALL STOCKER/SCRAPPER	14.00	6.385
REMAINDER OF COUNTIES:		
DRYWALL INSTALLER/LATHER	23.27	11.645
DRYWALL STOCKER/SCRAPPER	11.64	6.385

FOOTNOTE:		
Effective 8/1/99 new projects public or private, valued at twenty five million dollars or more shall be paid at the MARIN, NAPA, SOLANO and SONOMA rates.		

CARP0012B 09/01/1993		
	Rates	Fringes
ALPINE AND AMADOR COUNTIES:		
TILE FINISHER	12.80	3.12

CARP0034A 07/01/1999		
	Rates	Fringes
DIVERS:		
Diver standby	28.65	13.625
Diver wet pay	39.90	13.625
Tender	28.65	13.625
Saturation diver	46.50	13.625
Manned submersible	46.50	13.625
Manifold operator/life support Technician	30.65	13.625
Remote controlled vehicle-		
remote operated vehicle pilot	28.65	13.625
Bell winch operator	28.65	13.625

DEPTH PAY (Surface Diving):

50 to 100 ft	\$1.32/ft
100 to 150 ft	\$66.00 + \$1.85/ft
150 to 200 ft	\$158.00 + \$2.65/ft
200 ft and over	\$291.00 + \$3.00/ft

CARP0034B 07/01/2000

	Rates	Fringes
ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES:		
PILEDRIIVER	26.65	13.375
*PILEDRIIVER - BRIDGE BUILDER	23.77	11.205
MARIN, NAPA, SOLANO AND SONOMA COUNTIES:		
PILEDRIIVER	26.65	13.375
*PILEDRIIVER - BRIDGE BUILDER	28.00	11.205

*FOOTNOTE: Effective 7/1/99 new projects public or private, vaulued at twenty five million dollars or more PILEDRIIVER BRIDGE BUILDER shall be paid at the MARIN, NAPA, SOLANO AND SONOMA COUNTIES counties rate.

CARP0035C 07/01/2000

	Rates	Fringes
ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SUTTER, TEHAMA, TRINITY, YOLO,AND YUBA COUNTIES		
CARPENTER	22.77	11.205
HARDWOOD FLOORLAYER; SHINGLER;		
POWER SAW OPERATOR; STEEL		
SCAFFOLD AND STEEL SHORING		
ERECTOR; SAW FILER	22.92	11.205
BRIDGE BUILDERS	23.77	11.205
MILLWRIGHT	23.92	12.645
MARIN, NAPA, SOLANO AND SONOMA COUNTIES		
CARPENTER	28.00	11.205
HARDWOOD FLOOR LAYER; SHINGLER;		
POWER SAW OPERATOR; STEEL		
SCAFFOLD AND STEEL SHORING		
ERECTOR; SAW FILER	28.15	11.205
BRIDGE BUILDERS	28.00	11.205
MILLWRIGHT	28.00	12.645

FOOTNOTE: Effective 7/1/99 new projects public or private, vaulued at twenty five million dollars or more shall be paid at thr MARIN, NAPA, SOLANO AND SONOMA COUNTIES counties rate.

CARP0035H 07/01/1999

	Rates	Fringes
MODULAR FURNITURE INSTALLER	16.87	7.465

ELEC0006B 12/01/2000

	Rates	Fringes
COMMUNICATIONS AND SYSTEMS WORK:		
Communications and Systems		
Installer	23.32	3%+4.10

Communications and Systems

Technician	26.55	3%+4.10
------------	-------	---------

SCOPE OF WORK:

Including any data system whose only function is to transmit or receive information; excluding all other data systems or multiple systems which include control function or power supply; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding fire alarm work when installed in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs; excluding installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access; excluding energy management systems.

In the Counties of Fresno, Kings and Madera, fire alarm work shall be performed at the current inside wireman total cost package.

ELEC0077D 02/01/2000

	Rates	Fringes
MODOC AND SISKIYOU COUNTIES:		
LINE CONSTRUCTION AND OUTSIDE UTILITY TRANSMISSION WORK:		
Cable splicer, lead pole sprayer	29.41	3.5% + 6.85
Line technician, pole sprayer,		
heavy line equipment operator,		
line welder	26.52	3.5% + 6.85
Line equipment operator	22.86	3.5% + 5.10
Head ground person, powder worker,		
jackhammer operator	19.95	3.5% + 5.10
Ground person	18.74	3.5% + 5.10
Tree trimmer	20.57	3.5% + 5.10
Tree trimmer ground person	11.04	3.5% + 5.10

ELEC0180A 06/01/2000

	Rates	Fringes
NAPA AND SOLANO COUNTIES:		
ELECTRICIANS:		
Electrician	30.60	3% + 7.62
Cable splicer	34.43	3% + 7.62

ELEC0180B 06/01/1996

	Rates	Fringes
NAPA AND SOLANO COUNTIES		
LINE CONSTRUCTION:		
Line Technician	27.37	3%+6.00
Heavy Equipment Operator	23.26	3%+6.00
Truck Driver; Ground Person	20.53	3%+6.00

ELEC0340C 06/01/1996

	Rates	Fringes
ALPINE, AMADOR, COLUSA, EL DORADO, NEVADA, PLACER, SACRAMENTO, SIERRA, SUTTER, YOLO, AND YUBA COUNTIES		
ELECTRICAL SUBCONTRACTS \$5 MILLION AND OVER:		
Electrician	25.23	3%+7.30

Cable splicer	27.75	3%+7.30
Tunnel work	25.48	3%+7.30
ELECTRICAL SUBCONTRACTS UNDER		
\$5 MILLION:		
Electrician	24.59	3%+6.05
Cable splicer	27.05	3%+6.05
Tunnel work	24.84	3%+6.05

ELEC0442A 06/01/1996		
	Rates	Fringes
BUTTE, GLENN, PLUMAS, SHASTA, TEHAMA, AND TRINITY COUNTIES		
ELECTRICIANS:		
Electricians	20.00	3%+6.25
Cable splicers	22.00	3%+6.25
Tunnel work	21.00	3%+6.25

ELEC0442B 06/01/1996		
	Rates	Fringes
BUTTE, GLENN, PLUMAS, SHASTA, TEHAMA, AND TRINITY COUNTIES		
LINE CONSTRUCTION:		
Line technician	20.00	3%+6.25
Cable splicer	22.00	3%+6.25
Ground person	16.00	3%+6.25

ELEC0442C 06/01/1996		
	Rates	Fringes
LASSEN COUNTY (Sierra Army Depot, Herlong):		
ELECTRICIANS:		
Electrician	26.00	3%+6.25
Cable splicer	28.60	3%+6.25
REMAINDER OF LASSEN COUNTY:		
ELECTRICIANS:		
Electrician	20.00	3%+6.25
Cable Splicer	22.00	3%+6.25
Tunnel Work	21.00	3%+6.25

ELEC0442E 06/01/1996		
	Rates	Fringes
LASSEN COUNTY (Sierra Army Depot - Herlong)		
LINE CONSTRUCTION:		
Line Technician	26.00	3%+6.25
Cable Splicer	28.60	3%+6.25
Ground Person	20.80	3%+6.25
LASSEN COUNTY (Remainder)		
LINE CONSTRUCTION:		
Line Technician	20.00	3%+6.25
Cable Splicer	22.00	3%+6.25
Ground Person	16.00	3%+6.25

ELEC0551B 01/01/1996		
	Rates	Fringes
MARIN AND SONOMA COUNTIES		
LINE CONSTRUCTION:		
Line Technician	23.51	3%+8.45
Cable Splicer	25.39	3%+8.45
Heavy Equipment Operator	21.16	3%+8.035

Ground Person	18.81	3%+7.62

ELEC0551G 12/01/2000		
	Rates	Fringes
MARIN AND SONOMA COUNTIES		
ELECTRICIAN	29.75	3% + 8.51
CABLE SPLICER	32.63	3% + 8.51

ELEC0659K 01/01/2000		
	Rates	Fringes
MODOC and SISKIYOU COUNTIES:		
ELECTRICIANS	25.53	3% + 7.25

ELEC1245A 06/01/2000		
	Rates	Fringes
LINE CONSTRUCTION AND OUTSIDE UTILITY TRANSMISSION WORK:		
Line worker; Cable splicer	31.26	4.5% + 7.35
Powder worker	29.70	4.5% + 7.46
Ground person	20.32	4.5% + 7.58
Equipment specialist (operates crawler tractors, commercial motor vehicles, backhoes, trenchers, cranes (50 tons and below), and overhead and underground distribution line equipment)	26.57	4.5% + 7.07
Line worker, welding	32.82	4.5% + 7.53
SCOPE OF WORK:		
All outside work on electrical transmission lines, switchyards and substations, and outside work in electrical utility distribution systems owned, maintained and operated by electrical utility companies, municipalities, or governmental agencies.		

ELEV0008A 08/01/2000		
	Rates	Fringes
ELEVATOR MECHANIC	41.845	7.195
FOOTNOTE:		
Vacation Pay: 8% with 5 or more years of service, 6% for 6 months to 5 years service. Paid Holidays: New Years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Friday after, and Christmas Day.		

ENGI0001B 05/01/1999		
	Rates	Fringes
POWER EQUIPMENT OPERATORS		
CRANES AND ATTACHMENTS		
DREDGING		
TUNNEL AND UNDERGROUND		
These areas do not apply to piledrivers and steel erectors.		
AREA 1: BUTTE, MARIN, NAPA, SACRAMENTO, SOLANO, SUTTER, YOLO AND YUBA COUNTIES		
AREA 2: MODOC COUNTY		
The remaining counties are split between Area 1 and Area 2 as noted below:		
ALPINE COUNTY:		
AREA 1: Area within the line beginning at the northernmost		

point of Alpine County at the intersection of the California/Nevada state boundary,
Thence southeasterly along the state boundary to the intersection of the northerly line of Township 10N, Range 21E,
Thence westerly to the intersection of said county line and the northerly line of Township 10N, Range 18E,
Thence northerly along said county line to the point of beginning.

AREA 2: Remainder of Alpine County.

AMADOR COUNTY:

AREA 1: Area lying westerly of the east line of Range 14E.

AREA 2: Area lying easterly of the east line of Range 14E.

COLUSA COUNTY:

AREA 1: Area lying easterly of the east line of the following townships: Township 16N, Range 7W; Township 17N, Range 7W; Township 18N, Range 7W.

AREA 2: Remainder of Colusa County.

EL DORADO COUNTY:

AREA 1: Beginning at the point of intersection of the northerly line of El Dorado County with the easterly line of Range 10E,
Thence southwesterly along said county line to the southwest corner of said county,
Thence easterly along said county line to the intersection of the easterly line of Township 8N, Range 14#,
Thence northerly to the northeast corner of Township 10N, Range 14E,
Thence easterly along the 2nd standard parallel north to the intersection of the easterly line of said county,
Thence northerly along said county line to the California/Nevada State Border,
Thence northerly along said border to the northerly line of said county,
Thence westerly along the county line to the intersection with the easterly line of Township 14N, Range 14E,
Thence southerly to the southeast corner of Township 14N, Range 14E,
Thence easterly to the northeast corner of Township 13N, Range 15E,
Thence southerly to the southeast corner of Township 13N, Range 15E,
Thence easterly to the northeast corner of Township 12N, Range 16E,
Thence southerly to the southeast corner of Township 12N, Range 16E,
Thence westerly to the southeast corner of Township 12N, Range 10E,
Thence northerly along the township line to the point of beginning.

AREA 2: Remainder of El Dorado County.

GLENN COUNTY:

AREA 1: Area lying easterly of the east line of the following townships: Township 18N, Range 7W; Township 19N, Range 7W; Township 20N, Range 7W; Township 21N, Range 7W.

AREA 2: Remainder of Glenn County.

LASSEN COUNTY:

AREA 1: Area lying within the following townships: Township 27N, Range 8E; Township 28N, Range 8E; Township 30N, Range 6E; Township 31N, Range 6E; township 32N, Range 6E.

AREA 2: Remainder of Lassen County.

NEVADA COUNTY:

AREA 1: Area lying south and west of the following described line:

Beginning at the point of intersection of the northerly line of Nevada County with the easterly line of Township 18N, Range 10E,
Thence southerly to the southeast corner of Township 18N, Range 10E,
Thence easterly along the township line to the northeast corner of Township 17N, Range 14E,
Thence southerly to the northwest corner of Township 17N, Range 15E,
Thence easterly along the township line to the intersection of the California/Nevada state border.

AREA 2: Remainder of Nevada County.

PLACER COUNTY:

AREA 1: Beginning at the point of intersection of the northerly line of Placer County with the California/Nevada state border,

Thence southwesterly along said county line to the southwest corner of said county,
Thence easterly and northeasterly along said county line to the intersection with the easterly line of Range 10E,
Thence northerly to the northwest corner of Township 15N, Range 11E,
Thence easterly to the northeast corner of Township 15N, Range 11E,
Thence northerly to the northwest corner of Township 16N, Range 12E,
Thence easterly to the northwest corner of Township 16N, Range 12E,
Thence easterly to the northeast corner of Township 16N, Range 14E,
Thence southerly along the range line to the intersection of the southerly line of said county,
Thence easterly along said county line to the California/Nevada state border,
Thence northerly along said border to the point of beginning.

AREA 2: Remainder of Placer County.

PLUMAS COUNTY:

AREA 1: Beginning at the point of intersection of the northerly line of Plumas County with the easterly line of Township 30N, Range 6E,

Thence southerly to the southeast corner of Township 29N, Range 6E,
Thence easterly to the northeast corner of Township 28N, Range 8E,
Thence southerly to the southeast corner of Township 27N, Range 8E,

Thence westerly to the northeast corner of Township 27N,
Range 7E,
Thence southerly to the southwest corner of Township 23N,
Range 8E,
Thence easterly to the northeast corner of Township 22N,
Range 8E,
Thence southerly to the northwest corner of Township 21N,
Range 9E,
Thence easterly to the intersection of the Plumas County
line,
Thence southwesterly and northwesterly along said county
line to the most northwesterly point of said county,
Thence easterly along said county line to the point of
beginning.

AREA 2: Remainder of Plumas County.

SHASTA COUNTY:

AREA 1: Beginning at the intersection of the southerly line of
Shasta County with the easterly line of Township 29N, Range
9W,

Thence northerly to the southeast corner of Township 30N,
Range 9W,
Thence westerly to the southwest corner of Township 30N,
Range 9W,
Thence northerly along the range line to the intersection
of said county line,
Thence northerly along said county line to the intersection
with the southerly line of Township 35N,
Thence easterly to the southeast corner of Township 35N,
Range 7E,
Thence northerly to the northwest corner of Township 37N,
Range 6W,
Thence easterly to the northeast corner of Township 37N,
Range 6W,
Thence northerly to the northwest corner of Township 38N,
Range 5W,
Thence easterly along said county line to the intersection
with the easterly line of Township 39S, Range 1W,
Thence southerly to the southeast corner of Township 37N,
Range 1W,
Thence easterly to the northeast corner of Township 36N,
Range 3E,
Thence southerly to the northwest corner of Township 35N,
Range 4E,
Thence easterly to the northeast corner of Township 35N,
Range 4E,
Thence southerly to the northwest corner of Township 35N,
Range 5E,
Thence easterly to the northeast corner of Township 35N,
Range 5E,
Thence southerly to the northwest corner of Township 32N,
Range 6E,
Thence easterly to the intersection of said county line and
Township 32N,
Thence southerly and westerly along said county line to the
point of beginning.

AREA 2: Remainder of Shasta County.

SIERRA COUNTY:

AREA 1: Area lying southerly and westerly of a line beginning at a point of intersection of the southerly line of said county with the easterly line of Township 18N, Range 10E, Thence northerly to the northeast corner of Township 20N, Range 10E, Thence westerly to the southeast corner of Township 21N, Range 9E, Thence northerly to the northeast corner of Township 21N, Range 9E, Thence westerly along the township line to the intersection of the northerly line of said county.

AREA 2: Remainder of Sierra County.

SISKIYOU COUNTY:

AREA 1: Beginning at the point of intersection of the southerly line of Siskiyou County with the easterly line of Range 6W, Thence northerly to the northeast corner of Township 40N, Range 6W, Thence westerly to the southwest corner of Township 41N, Range 6W, Thence northerly to the southeast corner of Township 42N, Range 7W, Thence westerly to the southwest corner of Township 42N, Range 7W, Thence northerly to the southeast corner of Township 43N, Range 8W, Thence westerly to the southwest corner of Township 43N, Range 8W, Thence northerly along the range line to the California/Oregon border, Thence easterly along the state border to the intersection with the easterly line of Range 5W, Thence southerly to the northwest corner of Township 42N, Range 4W, Thence easterly to the northeast corner of Township 42N, Range 4W, Thence southerly to the southeast corner of Township 41N, Range 4W, Thence easterly to the northeast corner of Township 40N, Range 2W, Thence southerly along the range line to the southerly line of said county, Thence westerly along said county line to the point of beginning.

AREA 2: Remainder of Siskiyou County.

SONOMA COUNTY:

AREA 1: Area lying easterly and southeasterly of the east line of the following townships:

Township 8N, Range 13W
Township 9N, Range 13W
Township 10N, Range 13W
Township 11N, Range 13W

AREA 2: Remainder of Sonoma County.

TEHAMA COUNTY:

AREA 1: Area lying easterly of the east line of the following townships:

Township 23N, Range 9W
 Township 24N, Range 9W
 Township 25N, Range 9W
 Township 26N, Range 9W
 Township 27N, Range 9W
 Township 28N, Range 9W
 Township 29N, Range 9W

AREA 2: Remainder of Tehama County.

TRINITY COUNTY:

AREA 1: Area lying easterly of the line beginning at the intersection of the easterly line of Township 30N, Range 10W Mount Diablo Meridian (MDM) with the easterly line of Trinity County,

Thence northerly to the northeast corner of Township 30N, Range 10W MDM,

Thence northerly to the northeast corner of Township 30N, Range 10W MDM,

Thence westerly to the southwest corner of Township 31N, Range 10W, MDM,

Thence northerly to the northwest corner of Township 34N, Range 10W MDM,

Thence easterly to the northeast corner of Township 34N, Range 7W, MDM,

Thence northerly to the northwest corner of Township 37N, Range 6W MDM,

Thence easterly to the southwest corner of Township 38N, Range 5W MDM,

Thence northerly to the northeast corner of Township 40N, Range 6W MDM,

Thence westerly to the southwest corner of Township 41N, Range 6W MDM,

Thence northerly to the northwest corner of Township 41N, Range 6W MDM.

Also the area lying westerly of a line beginning at the southeast corner of Township 6N, Range 5E, of the Humboldt Meridian.

AREA 2: Remainder of Trinity County.

 ENGI0003B 07/01/1999

	Rates	Fringes
POWER EQUIPMENT OPERATORS:		
DREDGING: CLAMSHELL & DIPPER DREDGING;		
HYDRAULIC SUCTION DREDGING:		
AREA 1:		
Lever person/operator	32.79	11.16
Dredge dozer; Heavy duty		
repair person/welder	27.83	11.16
Booster pump operator; Deck		
engineer; Deck mate; Dredge		
tender; Winch operator	26.71	11.16
Barge person; Deckhand; Fire		
person; Leveehand; Oiler	23.41	11.16
AREA 2:		
Lever person/operator	34.79	11.16
Dredge dozer; Heavy duty		
repair person/welder	29.83	11.16

Booster pump operator; Deck engineer; Deck mate; Dredge tender; Winch operator	28.71	11.16
Barge person; Deckhand; Fire- person; Levee hand; Oiler	25.41	11.16

ENGI0003D 07/01/1999

	Rates	Fringes
ALPINE, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NAPA, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SONOMA, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES:		

BUILDING CONSTRUCTION:

POWER EQUIPMENT OPERATORS:

AREA 1:

GROUP 1	30.40	12.79
GROUP 2	28.95	12.79
GROUP 3	27.55	12.79
GROUP 4	26.22	12.79
GROUP 5	25.01	12.79
GROUP 6	23.74	12.79
GROUP 7	22.65	12.79
GROUP 8	21.57	12.79
GROUP 8-A	19.45	12.79

AREA 2:

GROUP 1	32.40	12.79
GROUP 2	30.95	12.79
GROUP 3	29.55	12.79
GROUP 4	28.22	12.79
GROUP 5	27.01	12.79
GROUP 6	25.74	12.79
GROUP 7	24.65	12.79
GROUP 8	23.57	12.79
GROUP 8-A	21.45	12.79

POWER EQUIPMENT OPERATORS - ALL CRANES AND ATTACHMENTS:

AREA 1:

GROUP 1	31.25	12.79
Truck crane oiler	24.59	12.79
Oiler	22.42	12.79
GROUP 2	29.56	12.79
Truck crane oiler	24.35	12.79
Oiler	22.20	12.79
GROUP 3	27.92	12.79
Truck crane oiler	24.11	12.79
Hydraulic	23.74	12.79
Oiler	21.95	12.79

AREA 2:

GROUP 1	33.25	12.79
Truck crane oiler	26.59	12.79
Oiler	24.42	12.79
GROUP 2	31.56	12.79
Truck crane oiler	26.35	12.79
Oiler	24.20	12.79
GROUP 3	29.92	12.79
Truck crane oiler	26.11	12.79
Hydraulic	25.74	12.79
Oiler	23.95	12.79

POWER EQUIPMENT OPERATORS - PILEDRIVERS:

GROUP 1	31.56	12.79
Truck crane oiler	24.91	12.79
Oiler	22.74	12.79
GROUP 2	29.85	12.79
Truck crane oiler	24.68	12.79
Oiler	22.49	12.79
GROUP 3	28.24	12.79
Truck crane oiler	24.41	12.79
Oiler	22.26	12.79
GROUP 4	26.54	12.79
GROUP 5	24.04	12.79
GROUP 6	21.90	12.79

POWER EQUIPMENT OPERATORS - STEEL ERECTION:

GROUP 1	32.19	12.79
Truck crane oiler	25.20	12.79
Oiler	23.06	12.79
GROUP 2	30.48	12.79
Truck crane oiler	24.98	12.79
Oiler	22.81	12.79
GROUP 3	29.09	12.79
Truck crane oiler	24.73	12.79
Hydraulic	24.35	12.79
Oiler	22.58	12.79
GROUP 4	27.16	12.79
GROUP 5	25.91	12.79

HEAVY AND HIGHWAY CONSTRUCTION:

POWER EQUIPMENT OPERATORS:

AREA 1:		
GROUP 1	31.82	12.79
GROUP 2	30.29	12.79
GROUP 3	28.81	12.79
GROUP 4	27.43	12.79
GROUP 5	26.16	12.79
GROUP 6	24.84	12.79
GROUP 7	23.70	12.79
GROUP 8	22.56	12.79
GROUP 8-A	20.35	12.79
AREA 2:		
GROUP 1	33.82	12.79
GROUP 2	32.29	12.79
GROUP 3	30.81	12.79
GROUP 4	29.43	12.79
GROUP 5	28.16	12.79
GROUP 6	26.84	12.79
GROUP 7	25.70	12.79
GROUP 8	24.56	12.79
GROUP 8-A	22.35	12.79

POWER EQUIPMENT OPERATORS - ALL CRANES AND ATTACHMENTS:

AREA 1:		
GROUP 1	32.70	12.79
Truck crane oiler	25.73	12.79
Oiler	23.44	12.79
GROUP 2	30.94	12.79
Truck crane oiler	25.47	12.79
Oiler	23.23	12.79

GROUP 3	29.20	12.79
Truck crane oiler	25.23	12.79
Hydraulic	24.84	12.79
Oiler	22.95	12.79
AREA 2:		
GROUP 1	34.70	12.79
Truck crane oiler	27.73	12.79
Oiler	25.44	12.79
GROUP 2	32.94	12.79
Truck crane oiler	27.47	12.79
Oiler	25.23	12.79
GROUP 3	31.20	12.79
Truck crane oiler	27.23	12.79
Hydraulic	26.84	12.79
Oiler	24.95	12.79
POWER EQUIPMENT OPERATORS - PILEDRIVERS:		
GROUP 1	33.04	12.79
Truck crane oiler	26.06	12.79
Oiler	23.78	12.79
GROUP 2	31.22	12.79
Truck crane oiler	25.81	12.79
Oiler	23.51	12.79
GROUP 3	29.54	12.79
Truck crane oiler	25.52	12.79
Oiler	23.29	12.79
GROUP 4	27.77	12.79
GROUP 5	25.13	12.79
GROUP 6	22.90	12.79
POWER EQUIPMENT OPERATORS - STEEL ERECTORS:		
GROUP 1	33.67	12.79
Truck crane oiler	26.35	12.79
Oiler	24.12	12.79
GROUP 2	31.90	12.79
Truck crane oiler	26.13	12.79
Oiler	23.85	12.79
GROUP 3	30.42	12.79
Truck crane oiler	25.86	12.79
Hydraulic	25.47	12.79
Oiler	23.63	12.79
GROUP 4	28.40	12.79
GROUP 5	27.10	12.79

FOOTNOTE:

Work suspended by ropes or cables, or work on a Yo-Yo Cat: \$.60 per hour additional.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Operator of helicopter (when used in erection work); Hydraulic excavator, 7 cu. yds. and over; Power shovels, over 7 cu. yds.

GROUP 2: Highline cableway; Hydraulic excavator, 3-1/2 cu. yds. up to 7 cu. yds.; Power blade operator (finish); Power shovels, over 1 cu. yd. up to and including 7 cu. yds. m.r.c.

GROUP 3: Asphalt milling machine; Cable backhoe; Combination backhoe and loader over 3/4 cu. yds.; Continuous flight tie back machine; Crane mounted continuous flight tie back machine; Crane mounted drill attachment, tonnage to apply; Dozer, slope brd; Gradall; Hydraulic excavator, up to 3 1/2 cu. yds.; Loader 4 cu.

yds. and over; Multiple engine scraper (when used as push pull); Power shovels, up to and including 1 cu. yd.; Pre-stress wire wrapping machine; Side boom cat, 572 or larger; Track loader 4 cu. yds. and over; Wheel excavator (up to and including 750 cu. yds. per hour)

GROUP 4: Asphalt plant engineer/box person; Chicago boom; Combination backhoe and loader up to and including 3/4 cu. yd.; Concrete batch plant (wet or dry); Dozer and/or push cat; Pull-type elevating loader; Gradesetter, grade checker (mechanical or otherwise); Grooving and grinding machine; Heading shield operator; Heavy-duty drilling equipment, Hughes, LDH, Watson 3000 or similar; Heavy-duty repairperson and/or welder; Lime spreader; Loader under 4 cu. yds.; Lubrication and service engineer (mobile and grease rack); Mechanical finishers or spreader machine (asphalt, Barber-Greene and similar); Miller Formless M-9000 slope paver or similar; Portable crushing and screening plants; Power blade support; Roller operator, asphalt; Rubber-tired scraper, self-loading (paddle-wheels, etc.); Rubber-tired earthmoving equipment (scrapers); Slip form paver (concrete); Small tractor with drag; Soil stabilizer (P & H or equal); Timber skidder; Track loader up to 4 yds.; Tractor-drawn scraper; Tractor, compressor drill combination; Welder; Woods-Mixer (and other similar Pugmill equipment)

GROUP 5: Cast-in-place pipe laying machine; Combination slusher and motor operator; Concrete conveyor or concrete pump, truck or equipment mounted; Concrete conveyor, building site; Concrete pump or pumpcrete gun; Drilling equipment, Watson 2000, Texoma 700 or similar; Drilling and boring machinery, horizontal (not to apply to waterliners, wagon drills or jackhammers); Concrete mixer/all; Person and/or material hoist; Mechanical finishers (concrete) (Clary, Johnson, Bidwell Bridge Deck or similar types); Mechanical burm, curb and/or curb and gutter machine, concrete or asphalt; Mine or shaft hoist; Portable crusher; Power jumbo operator (setting slip-forms, etc., in tunnels); Screed (automatic or manual); Self-propelled compactor with dozer; Tractor with boom D6 or smaller; Trenching machine, maximum digging capacity over 5 ft. depth; Vermeer T-600B rock cutter or similar

GROUP 6: Armor-Coater (or similar); Ballast jack tamper; Boom-type backfilling machine; Assistant plant engineer; Bridge and/or gantry crane; Chemical grouting machine, truck-mounted; Chip spreading machine operator; Concrete saw (self-propelled unit on streets, highways, airports and canals); Deck engineer; Drilling equipment Texoma 600, Hughes 200 Series or similar up to and including 30 ft. m.r.c.; Drill doctor; Helicopter radio operator; Hydro-hammer or similar; Line master; Skidsteer loader, Bobcat larger than 743 series or similar (with attachments); Locomotive; Lull hi-lift or similar; Oiler, truck mounted equipment; Pavement breaker, truck-mounted, with compressor combination; Paving fabric installation and/or laying machine; Pipe bending machine (pipelines only); Pipe wrapping machine (tractor propelled and supported); Screed (except asphaltic concrete paving); Self-propelled pipeline wrapping machine; Soils & materials tester; Tractor

GROUP 7: Ballast regulator; Boom truck or dual-purpose A-frame truck, non-rotating - under 15 tons; Truck-mounted rotating

telescopic boom type lifting device, Manitex or similar (boom truck) - under 15 tons; Cary lift or similar; Combination slurry mixer and/or cleaner; Drilling equipment, 20 ft. and under m.r.c.; Firetender (hot plant); Grouting machine operator; Highline cableway signalperson; Stationary belt loader (Kolman or similar); Lift slab machine (Vagtborg and similar types); Maginnes internal full slab vibrator; Material hoist (1 drum); Mechanical trench shield; Pavement breaker with or without compressor combination; Pipe cleaning machine (tractor propelled and supported); Post driver; Roller (except asphalt); Chip Seal; Self-propelled automatically applied concrete curing machine (on streets, highways, airports and canals); Self-propelled compactor (without dozer); Signalperson; Slip-form pumps (lifting device for concrete forms); Tie spacer; Tower mobile; Trenching machine, maximum digging capacity up to and including 5 ft. depth; Truck-type loader

GROUP 8: Bit sharpener; Boiler tender; Box operator; Brakeperson; Combination mixer and compressor (shotcrete/gunite); Compressor operator; Deckhand; Fire tender; Forklift (under 20 ft.); Generator; Guniting/shotcrete equipment operator; Hydraulic monitor; Ken seal machine (or similar); Mixermobile; Oiler; Pump operator; Refrigeration plant; Reservoir-debris tug (self-propelled floating); Ross Carrier (construction site); Rotomist operator; Self-propelled tape machine; Shuttlecar; Self-propelled power sweeper operator; Slusher operator; Surface heater; Switchperson; Tar pot firetender; Tugger hoist, single drum; Vacuum cooling plant; Welding machine (powered other than by electricity)

GROUP 8-A: Elevator operator; Skidsteer loader - Bobcat 743 series or smaller, and similar (without attachments); Mini excavator under 25 H.P. (backhoe - trencher)

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

ALL CRANES AND ATTACHMENTS

GROUP 1: Clamshell and dragline over 7 cu. yds.; Crane, over 100 tons; Derrick, over 100 tons; Derrick barge pedestal-mounted, over 100 tons; Self-propelled boom-type lifting device, over 100 tons

GROUP 2: Clamshell and dragline over 1 cu. yd. up to and including 7 cu. yds.; Crane, over 45 tons up to and including 100 tons; Derrick barge, 100 tons and under; Self-propelled boom-type lifting device, over 45 tons; Tower crane

GROUP 3: Clamshell and dragline up to and including 1 cu. yd.; Crane, 45 tons and under; Self-propelled boom-type lifting device, 45 tons and under; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) - under 15 tons; Boom truck or dual purpose A-frame truck, non-rotating, over 15 tons

POWER EQUIPMENT OPERATORS - PILEDRIVERS

GROUP 1: Derrick barge pedestal mounted over 100 tons; Clamshell over 7 cu. yds.; Self-propelled boom-type lifting device over 100 tons; Truck crane or crawler, land or barge mounted over 100 tons

GROUP 2: Derrick barge pedestal mounted 45 tons to and including 100 tons; Clamshell up to and including 7 cu. yds.; Self-propelled boom-type lifting device over 45 tons; Truck crane or crawler, land or barge mounted, over 45 tons up to and

including 100 tons

GROUP 3: Derrick barge pedestal mounted under 45 tons; Self-propelled boom-type lifting device 45 tons and under; Skid/scow piledriver, any tonnage; Truck crane or crawler, land or barge mounted 45 tons and under

GROUP 4: Assistant operator in lieu of assistant to engineer; Forklift, 10 tons and over; Heavy-duty repairperson/welder

GROUP 5: Deck engineer

GROUP 6: Deckhand; Fire tender

POWER EQUIPMENT OPERATORS - STEEL ERECTORS

GROUP 1: Crane over 100 tons; Derrick over 100 tons; Self-propelled boom-type lifting device over 100 tons

GROUP 2: Crane over 45 tons to 100 tons; Derrick under 100 tons; Self-propelled boom-type lifting device over 45 tons to 100 tons; Tower crane

GROUP 3: Crane, 45 tons and under; Self-propelled boom-type lifting device, 45 tons and under

GROUP 4: Chicago boom; Forklift, 10 tons and over; Heavy-duty repair person/welder

GROUP 5: Boom cat

ENGI0003E 06/16/2000

	Rates	Fringes
MARIN AND SOLANO COUNTIES:		
POWER EQUIPMENT OPERATORS:		
GROUP 1	32.82	12.70
GROUP 2	31.29	12.70
GROUP 3	29.81	12.70
GROUP 4	28.43	12.70
GROUP 5	27.16	12.70
GROUP 6	25.84	12.70
GROUP 7	24.70	12.70
GROUP 8	23.56	12.70
GROUP 8-A	21.35	12.70
POWER EQUIPMENT OPERATORS - ALL CRANES AND ATTACHMENTS:		
GROUP 1	33.70	12.70
Truck crane oiler	26.73	12.70
Oiler	24.44	12.70
GROUP 2	31.94	12.70
Truck crane oiler	26.47	12.70
Oiler	24.23	12.70
GROUP 3	30.20	12.70
Truck crane oiler	26.23	12.70
Hydraulic	25.84	12.70
Oiler	23.95	12.70
POWER EQUIPMENT OPERATORS - PILEDRIVERS:		
GROUP 1	34.04	12.70
Truck crane oiler	27.06	12.70
Oiler	24.78	12.70
GROUP 2	32.22	12.70
Truck crane oiler	26.81	12.70
Oiler	24.51	12.70
GROUP 3	30.54	12.70
Truck crane oiler	26.52	12.70
Oiler	24.29	12.70
GROUP 4	28.77	12.70

GROUP 5	26.13	12.70
GROUP 6	23.90	12.70
POWER EQUIPMENT OPERATORS - STEEL ERECTORS:		
GROUP 1	34.67	12.70
Truck crane oiler	27.35	12.70
Oiler	25.12	12.70
GROUP 2	32.90	12.70
Truck crane oiler	27.13	12.70
Oiler	24.85	12.70
GROUP 3	31.42	12.70
Truck crane oiler	26.86	12.70
Hydraulic	26.47	12.70
Oiler	24.63	12.70
GROUP 4	29.40	12.70
GROUP 5	28.10	12.70

FOOTNOTE:

Work suspended by ropes or cables, or work on a Yo-Yo Cat: \$.60 per hour additional.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Operator of helicopter (when used in erection work); Hydraulic excavator, 7 cu. yds. and over; Power shovels, over 7 cu. yds.

GROUP 2: Highline cableway; Hydraulic excavator, 3-1/2 cu. yds. up to 7 cu. yds.; Power blade operator (finish); Power shovels, over 1 cu. yd. up to and including 7 cu. yds. m.r.c.

GROUP 3: Asphalt milling machine; Cable backhoe; Combination backhoe and loader over 3/4 cu. yds.; Continuous flight tie back machine; Crane mounted continuous flight tie back machine; Crane mounted drill attachment, tonnage to apply; Dozer, slope brd; Gradall; Hydraulic excavator, up to 3 1/2 cu. yds.; Loader 4 cu. yds. and over; Multiple engine scraper (when used as push pull); Power shovels, up to and including 1 cu. yd.; Pre-stress wire wrapping machine; Side boom cat, 572 or larger; Track loader 4 cu. yds. and over; Wheel excavator (up to and including 750 cu. yds. per hour)

GROUP 4: Asphalt plant engineer/box person; Chicago boom; Combination backhoe and loader up to and including 3/4 cu. yd.; Concrete batch plant (wet or dry); Dozer and/or push cat; Pull-type elevating loader; Gradesetter, grade checker (mechanical or otherwise); Grooving and grinding machine; Heading shield operator; Heavy-duty drilling equipment, Hughes, LDH, Watson 3000 or similar; Heavy-duty repairperson and/or welder; Lime spreader; Loader under 4 cu. yds.; Lubrication and service engineer (mobile and grease rack); Mechanical finishers or spreader machine (asphalt, Barber-Greene and similar); Miller Formless M-9000 slope paver or similar; Portable crushing and screening plants; Power blade support; Roller operator, asphalt; Rubber-tired scraper, self-loading (paddle-wheels, etc.); Rubber-tired earthmoving equipment (scrapers); Slip form paver (concrete); Small tractor with drag; Soil stabilizer (P & H or equal); Timber skidder; Track loader up to 4 yds.; Tractor-drawn scraper; Tractor, compressor drill combination; Welder; Woods-Mixer (and other similar Pugmill equipment)

GROUP 5: Cast-in-place pipe laying machine; Combination slusher and motor operator; Concrete conveyor or concrete pump, truck or equipment mounted; Concrete conveyor, building site; Concrete

pump or pumpcrete gun; Drilling equipment, Watson 2000, Texoma 700 or similar; Drilling and boring machinery, horizontal (not to apply to waterliners, wagon drills or jackhammers); Concrete mixer/all; Person and/or material hoist; Mechanical finishers (concrete) (Clary, Johnson, Bidwell Bridge Deck or similar types); Mechanical burm, curb and/or curb and gutter machine, concrete or asphalt); Mine or shaft hoist; Portable crusher; Power jumbo operator (setting slip-forms, etc., in tunnels); Screed (automatic or manual); Self-propelled compactor with dozer; Tractor with boom D6 or smaller; Trenching machine, maximum digging capacity over 5 ft. depth; Vermeer T-600B rock cutter or similar

GROUP 6: Armor-Coater (or similar); Ballast jack tamper; Boom-type backfilling machine; Assistant plant engineer; Bridge and/or gantry crane; Chemical grouting machine, truck-mounted; Chip spreading machine operator; Concrete saw (self-propelled unit on streets, highways, airports and canals); Deck engineer; Drilling equipment Texoma 600, Hughes 200 Series or similar up to and including 30 ft. m.r.c.; Drill doctor; Helicopter radio operator; Hydro-hammer or similar; Line master; Skidsteer loader, Bobcat larger than 743 series or similar (with attachments); Locomotive; Lull hi-lift or similar; Oiler, truck mounted equipment; Pavement breaker, truck-mounted, with compressor combination; Paving fabric installation and/or laying machine; Pipe bending machine (pipelines only); Pipe wrapping machine (tractor propelled and supported); Screed (except asphaltic concrete paving); Self-propelled pipeline wrapping machine; Soils & materials tester; Tractor

GROUP 7: Ballast regulator; Boom truck or dual-purpose A-frame truck, non-rotating - under 15 tons; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) - under 15 tons; Cary lift or similar; Combination slurry mixer and/or cleaner; Drilling equipment, 20 ft. and under m.r.c.; Firetender (hot plant); Grouting machine operator; Highline cableway signalperson; Stationary belt loader (Kolman or similar); Lift slab machine (Vagtborg and similar types); Maginnes internal full slab vibrator; Material hoist (1 drum); Mechanical trench shield; Pavement breaker with or without compressor combination); Pipe cleaning machine (tractor propelled and supported); Post driver; Roller (except asphalt); Chip Seal; Self-propelled automatically applied concrete curing machine (on streets, highways, airports and canals); Self-propelled compactor (without dozer); Signalperson; Slip-form pumps (lifting device for concrete forms); Tie spacer; Tower mobile; Trenching machine, maximum digging capacity up to and including 5 ft. depth; Truck-type loader

GROUP 8: Bit sharpener; Boiler tender; Box operator; Brakeperson; Combination mixer and compressor (shotcrete/gunite); Compressor operator; Deckhand; Fire tender; Forklift (under 20 ft.); Generator; Guniting/shotcrete equipment operator; Hydraulic monitor; Ken seal machine (or similar); Mixermobile; Oiler; Pump operator; Refrigeration plant; Reservoir-debris tug (self-propelled floating); Ross Carrier (construction site); Rotomist operator; Self-propelled tape machine; Shuttlecar; Self-propelled power sweeper operator; Slusher operator; Surface heater; Switchperson; Tar pot firetender; Tugger hoist, single drum;

Vacuum cooling plant; Welding machine (powered other than by electricity)

GROUP 8-A: Elevator operator; Skidsteer loader - Bobcat 743 series or smaller, and similar (without attachments); Mini excavator under 25 H.P. (backhoe - trencher)

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

ALL CRANES AND ATTACHMENTS

GROUP 1: Clamshell and dragline over 7 cu. yds.; Crane, over 100 tons; Derrick, over 100 tons; Derrick barge pedestal-mounted, over 100 tons; Self-propelled boom-type lifting device, over 100 tons

GROUP 2: Clamshell and dragline over 1 cu. yd. up to and including 7 cu. yds.; Crane, over 45 tons up to and including 100 tons; Derrick barge, 100 tons and under; Self-propelled boom-type lifting device, over 45 tons; Tower crane

GROUP 3: Clamshell and dragline up to and including 1 cu. yd.; Crane, 45 tons and under; Self-propelled boom-type lifting device, 45 tons and under; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) - under 15 tons; Boom truck or dual purpose A-frame truck, non-rotating, over 15 tons

POWER EQUIPMENT OPERATORS - PILEDRIVERS

GROUP 1: Derrick barge pedestal mounted over 100 tons; Clamshell over 7 cu. yds.; Self-propelled boom-type lifting device over 100 tons; Truck crane or crawler, land or barge mounted over 100 tons

GROUP 2: Derrick barge pedestal mounted 45 tons to and including 100 tons; Clamshell up to and including 7 cu. yds.; Self-propelled boom-type lifting device over 45 tons; Truck crane or crawler, land or barge mounted, over 45 tons up to and including 100 tons

GROUP 3: Derrick barge pedestal mounted under 45 tons; Self-propelled boom-type lifting device 45 tons and under; Skid/scow piledriver, any tonnage; Truck crane or crawler, land or barge mounted 45 tons and under

GROUP 4: Assistant operator in lieu of assistant to engineer; Forklift, 10 tons and over; Heavy-duty repairperson/welder

GROUP 5: Deck engineer

GROUP 6: Deckhand; Fire tender

POWER EQUIPMENT OPERATORS - STEEL ERECTORS

GROUP 1: Crane over 100 tons; Derrick over 100 tons; Self-propelled boom-type lifting device over 100 tons

GROUP 2: Crane over 45 tons to 100 tons; Derrick under 100 tons; Self-propelled boom-type lifting device over 45 tons to 100 tons; Tower crane

GROUP 3: Crane, 45 tons and under; Self-propelled boom-type lifting device, 45 tons and under

GROUP 4: Chicago boom; Forklift, 10 tons and over; Heavy-duty repair person/welder

GROUP 5: Boom cat

ENGI0003G 06/16/2000

Rates

Fringes

POWER EQUIPMENT OPERATORS:

TUNNEL AND UNDERGROUND WORK:

AREA 1:

UNDERGROUND:

GROUP 1-A	31.29	12.70
GROUP 1	28.82	12.70
GROUP 2	27.56	12.70
GROUP 3	27.23	12.70
GROUP 4	25.09	12.70
GROUP 5	23.95	12.70

SHAFTS, STOPES AND RAISES:

GROUP 1-A	31.39	12.70
GROUP 1	28.92	12.70
GROUP 2	27.66	12.70
GROUP 3	26.33	12.70
GROUP 4	25.19	12.70
GROUP 5	24.05	12.70

AREA 2:

UNDERGROUND:

GROUP 1-A	33.29	12.70
GROUP 1	30.82	12.70
GROUP 2	29.56	12.70
GROUP 3	28.23	12.70
GROUP 4	27.09	12.70
GROUP 5	25.95	12.70

SHAFTS, STOPES AND RAISES:

GROUP 1-A	33.39	12.70
GROUP 1	30.92	12.70
GROUP 2	29.66	12.70
GROUP 3	28.33	12.70
GROUP 4	27.19	12.70
GROUP 5	26.05	12.70

FOOTNOTE:

Work suspended by ropes or cables, or work on a Yo-Yo Cat: \$.60 per hour additional.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1-A: Tunnel bore machine operator, 20' diameter or more

GROUP 1: Heading shield operator; Heavy-duty repairperson/welder; Mucking machine (rubber tired, rail or track type); Raised bore operator (tunnels); Tunnel mole bore operator

GROUP 2: Combination slusher and motor operator; Concrete pump or pumpcrete gun; Power jumbo operator

GROUP 3: Drill doctor; Mine or shaft hoist

GROUP 4: Combination slurry mixer cleaner; Grouting machine operator; Motor person

GROUP 5: Bit sharpener; Brake person; Combination mixer and compressor (gunite); Compressor operator; Oiler (assistant to engineer); Pump operator; Slusher operator

 ENGI0003N 06/16/2000

Rates

Fringes

AMADOR COUNTY:

HEAVY AND HIGHWAY CONSTRUCTION:

POWER EQUIPMENT OPERATORS:

AREA 1:

GROUP 1	32.82	12.70
GROUP 2	31.29	12.70
GROUP 3	29.81	12.70
GROUP 4	28.43	12.70

GROUP 5	27.16	12.70
GROUP 6	25.84	12.70
GROUP 7	24.70	12.70
GROUP 8	23.56	12.70
GROUP 8-A	21.35	12.70
AREA 2:		
GROUP 1	34.82	12.70
GROUP 2	33.29	12.70
GROUP 3	31.81	12.70
GROUP 4	30.43	12.70
GROUP 5	29.16	12.70
GROUP 6	27.84	12.70
GROUP 7	26.70	12.70
GROUP 8	25.56	12.70
GROUP 8-A	23.35	12.70
POWER EQUIPMENT OPERATORS - ALL CRANES AND ATTACHMENTS:		
AREA 1:		
GROUP 1	33.70	12.70
Truck crane oiler	26.73	12.70
Oiler	24.44	12.70
GROUP 2	31.94	12.70
Truck crane oiler	26.47	12.70
Oiler	24.23	12.70
GROUP 3	30.20	12.70
Truck crane oiler	26.23	12.70
Hydraulic	25.84	12.70
Oiler	23.95	12.70
AREA 2:		
GROUP 1	35.70	12.70
Truck crane oiler	28.73	12.70
Oiler	26.44	12.70
GROUP 2	33.94	12.70
Truck crane oiler	28.47	12.70
Oiler	26.23	12.70
GROUP 3	32.20	12.70
Truck crane oiler	28.23	12.70
Hydraulic	27.84	12.70
Oiler	25.95	12.70
POWER EQUIPMENT OPERATORS - PILEDRIVERS:		
GROUP 1	34.04	12.70
Truck crane oiler	27.06	12.70
Oiler	24.78	12.70
GROUP 2	32.22	12.70
Truck crane oiler	26.81	12.70
Oiler	24.51	12.70
GROUP 3	30.54	12.70
Truck crane oiler	26.52	12.70
Oiler	24.29	12.70
GROUP 4	28.77	12.70
GROUP 5	26.13	12.70
GROUP 6	23.90	12.70
POWER EQUIPMENT OPERATORS - STEEL ERECTORS:		
GROUP 1	34.67	12.70
Truck crane oiler	27.35	12.70
Oiler	25.12	12.70
GROUP 2	32.90	12.70

Truck crane oiler	27.13	12.70
Oiler	24.85	12.70
GROUP 3	31.42	12.70
Truck crane oiler	26.86	12.70
Hydraulic	26.47	12.70
Oiler	24.63	12.70
GROUP 4	29.40	12.70
GROUP 5	28.10	12.70

FOOTNOTE:

Work suspended by ropes or cables, or work on a Yo-Yo Cat: \$.60 per hour additional.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Operator of helicopter (when used in erection work); Hydraulic excavator, 7 cu. yds. and over; Power shovels, over 7 cu. yds.

GROUP 2: Highline cableway; Hydraulic excavator, 3-1/2 cu. yds. up to 7 cu. yds.; Power blade operator (finish); Power shovels, over 1 cu. yd. up to and including 7 cu. yds. m.r.c.

GROUP 3: Asphalt milling machine; Cable backhoe; Combination backhoe and loader over 3/4 cu. yds.; Continuous flight tie back machine; Crane mounted continuous flight tie back machine; Crane mounted drill attachment, tonnage to apply; Dozer, slope brd; Gradall; Hydraulic excavator, up to 3 1/2 cu. yds.; Loader 4 cu. yds. and over; Multiple engine scraper (when used as push pull); Power shovels, up to and including 1 cu. yd.; Pre-stress wire wrapping machine; Side boom cat, 572 or larger; Track loader 4 cu. yds. and over; Wheel excavator (up to and including 750 cu. yds. per hour)

GROUP 4: Asphalt plant engineer/boxman; Chicago boom; Combination backhoe and loader up to and including 3/4 cu. yd.; Concrete batch plant (wet or dry); Dozer and/or push cat; Pull-type elevating loader; Gradesetter, grade checker (mechanical or otherwise); Grooving and grinding machine; Heading shield operator; Heavy-duty drilling equipment, Hughes, LDH, Watson 3000 or similar; Heavy-duty repairperson and/or welder; Lime spreader; Loader under 4 cu. yds.; Lubrication and service engineer (mobile and grease rack); Mechanical finishers or spreader machine (asphalt, Barber-Greene and similar); Miller Formless M-9000 slope paver or similar; Portable crushing and screening plants; Power blade support; Roller operator, asphalt; Rubber-tired scraper, self-loading (paddle-wheels, etc.); Rubber-tired earthmoving equipment (scrapers); Slip form paver (concrete); Small tractor with drag; Soil stabilizer (P & H or equal); Timber skidder; Track loader up to 4 yds.; Tractor-drawn scraper; Tractor, compressor drill combination; Welder; Woods-Mixer (and other similar Pugmill equipment)

GROUP 5: Cast-in-Place pipe laying machine; Combination slusher and motor operator; Concrete conveyor or concrete pump, truck or equipment mounted; Concrete conveyor, building site; Concrete pump or pumpcrete gun; Drilling equipment, Watson 2000, Texoma 700 or similar; Drilling and boring machinery, horizontal (not to apply to waterliners, wagon drills or jackhammers); Concrete mixer/all; Person and/or material hoist; Mechanical finishers (concrete) (Clary, Johnson, Bidwell Bridge Deck or similar types); Mechanical burm, curb and/or curb and gutter machine, concrete or asphalt; Mine or shaft hoist; Portable crusher;

Power jumbo operator (setting slip-forms, etc., in tunnels); Screed (automatic or manual); Self-propelled compactor with dozer; Tractor with boom D6 or smaller; Trenching machine, maximum digging capacity over 5 ft. depth; Vermeer T-600B rock cutter or similar

GROUP 6: Armor-Coater (or similar); Ballast jack tamper; Boom-type backfilling machine; Assistant plant engineer; Bridge and/or gantry crane; Chemical grouting machine, truck-mounted; Chip spreading machine operator; Concrete saw (self-propelled unit on streets, highways, airports and canals); Deck engineer; Drilling equipment Texoma 600, Hughes 200 Series or similar up to and including 30 ft. m.r.c.; Drill doctor; Helicopter radio operator; Hydro-hammer or similar; Line master; Skidsteer loader, Bobcat larger than 743 series or similar (with attachments); Locomotive; Lull hi-lift or similar; Oiler, truck mounted equipment; Pavement breaker, truck-mounted, with compressor combination; Paving fabric installation and/or laying machine; Pipe bending machine (pipelines only); Pipe wrapping machine (tractor propelled and supported); Screed (except asphaltic concrete paving); Self-propelled pipeline wrapping machine; Soils & materials tester; Tractor

GROUP 7: Ballast regulator; Boom truck or dual-purpose A-frame truck, non-rotating - under 15 tons; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) - under 15 tons; Cary lift or similar; Combination slurry mixer and/or cleaner; Drilling equipment, 20 ft. and under m.r.c.; Firetender (hot plant); Grouting machine operator; Highline cableway signalperson; Stationary belt loader (Kolman or similar); Lift slab machine (Vagtborg and similar types); Maginnes internal full slab vibrator; Material hoist (1 drum); Mechanical trench shield; Pavement breaker with or without compressor combination; Pipe cleaning machine (tractor propelled and supported); Post driver; Roller (except asphalt), Chip Seal; Self-propelled automatically applied concrete curing machine (on streets, highways, airports and canals); Self-propelled compactor (without dozer); Signalperson; Slip-form pumps (lifting device for concrete forms); Tie spacer; Tower mobile; Trenching machine, maximum digging capacity up to and including 5 ft. depth; Truck-type loader

GROUP 8: Bit sharpener; Boiler tender; Box operator; Brakeperson; Combination mixer and compressor (shotcrete/gunite); Compressor operator; Deckhand; Fire tender; Forklift (under 20 ft.); Generator; Gunite/shotcrete equipment operator; Hydraulic monitor; Ken seal machine (or similar); Mixermobile; Oiler; Pump operator; Refrigeration plant; Reservoir-debris tug (self-propelled floating); Ross Carrier (construction site); Rotomist operator; Self-propelled tape machine; Shuttlecar; Self-propelled power sweeper operator; Slusher operator; Surface heater; Switchperson; Tar pot firetender; Tugger hoist, single drum; Vacuum cooling plant; Welding machine (powered other than by electricity)

GROUP 8-A: Elevator operator; Skidsteer loader - Bobcat 743 series or smaller, and similar (without attachments); Mini excavator under 25 H.P. (backhoe - trencher)

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

ALL CRANES AND ATTACHMENTS

GROUP 1: Clamshell and Dragline over 7 cu. yds.; Crane, over 100 tons; Derrick, over 100 tons; Derrick barge pedestal-mounted, over 100 tons; Self-propelled boom-type lifting device, over 100 tons

GROUP 2: Clamshell and Dragline over 1 cu. yd. up to and including 7 cu. yds.; Crane, over 45 tons up to and including 100 tons; Derrick barge, 100 tons and under; Self-propelled boom-type lifting device, over 45 tons; Tower crane

GROUP 3: Clamshell and Dragline up to and including 1 cu. yd.; Crane, 45 tons and under; Self-propelled boom-type lifting device, 45 tons and under; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) -under 15 tons; Boom truck or dual purpose A-frame truck, non-rotating, over 15 tons

POWER EQUIPMENT OPERATORS - PILEDRIVER CLASSIFICATIONS

GROUP 1: Derrick barge pedestal mounted over 100 tons; Clamshell over 7 cu. yds.; Self-propelled boom-type lifting device over 100 tons; Truck crane or crawler, land or barge mounted over 100 tons

GROUP 2: Derrick barge pedestal mounted 45 tons to and including 100 tons; Clamshell up to and including 7 cu. yds.; Self-propelled boom-type lifting device over 45 tons; Truck crane or crawler, land or barge mounted, over 45 tons up to and including 100 tons

GROUP 3: Derrick barge pedestal mounted under 45 tons; Self-propelled boom-type lifting device 45 tons and under; Skid/scow piledriver, any tonnage; Truck crane or crawler, land or barge mounted 45 tons and under

GROUP 4: Assistant operator in lieu of assistant to engineer; Forklift, 10 tons and over; Heavy-duty repairperson/welder

GROUP 5: Deck engineer

GROUP 6: Deckhand; Fire tender

POWER EQUIPMENT OPERATORS - STEEL ERECTOR CLASSIFICATIONS

GROUP 1: Crane over 100 tons; Derrick over 100 tons; Self-propelled Boom-type lifting device over 100 tons

GROUP 2: Crane over 45 tons to 100 tons; Derrick under 100 tons; Self-propelled boom-type lifting device over 45 tons to 100 tons; Tower Crane

GROUP 3: Crane, 45 tons and under; Self-propelled Boom-type lifting device, 45 tons and under

GROUP 4: Chicago Boom; Forklift, 10 tons and over; Heavy-duty Repair Person/Welder

GROUP 5: Boom Cat

IRON0001N 07/01/2000

	Rates	Fringes
ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, MARIN, MODOC, NAPA, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SOLANO, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES:		

IRONWORKERS:

Fence erector	23.94	14.375
Ornamental, reinforcing and structural	24.83	14.375

IRON0001W 07/01/2000

	Rates	Fringes
LASSEN COUNTY:		
IRONWORKERS:		
Fence erector	23.94	14.375
Ornamental, reinforcing and structural	24.83	14.375
FOOTNOTE:		
Work at Susanville Federal Prison: \$3.00 per hour additional.		

IRON0001X 07/01/2000

	Rates	Fringes
SONOMA COUNTY:		
IRONWORKERS:		
Fence erector	23.94	14.375
Ornamental, reinforcing and structural	24.83	14.375
FOOTNOTE:		
Work at the U.S. Coast Guard - Two Rock: \$1.00 per hour additional.		

* LAB00067C 12/01/2000

	Rates	Fringes
ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MARIN, NAPA, MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SOLANO, SONOMA, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES:		
ASBESTOS REMOVAL LABORER	22.07	7.36
SCOPE OF WORK:		
Covers site mobilization; initial site clean-up; site preparation; removal of asbestos-containing materials from walls and ceilings; or from pipes, boilers and mechanical systems only if they are being scrapped; encapsulation, enclosure and disposal of asbestos-containing materials by hand or with equipment or machinery; scaffolding; fabrication of temporary wooden barriers; and assembly of decontamination stations.		

* LAB00067F 06/26/2000

	Rates	Fringes
MARIN COUNTY:		
LABORERS:		
Construction specialist group	22.86	7.76
GROUP 1	22.16	7.76
GROUP 1-a	22.38	7.76
GROUP 1-b: see note below		
GROUP 1-c	22.21	7.76
GROUP 1-d: see note below		
GROUP 1-e	22.71	7.76
GROUP 1-f	22.74	7.76
GROUP 2	22.01	7.76
GROUP 3	21.91	7.76
GROUP 4	15.60	7.76
See groups 1-b and 1-d under laborer classifications.		
GUNITE LABORERS:		
GROUP 1	23.12	7.76
GROUP 2	22.62	7.76

GROUP 3	22.03	7.76
GROUP 4	21.91	7.76
WRECKING WORK:		
GROUP 1	22.16	7.76
GROUP 2	21.01	7.76
GROUP 3	15.60	7.76
GARDENERS, HORTICULTURAL AND LANDSCAPE		
LABORERS:		
New construction	21.91	7.76
Establishment warranty period	15.60	7.76
TUNNEL AND SHAFT LABORERS:		
GROUP 1	26.52	7.76
GROUP 2	26.29	7.76
GROUP 3	26.04	7.76
GROUP 4	25.77	7.76
GROUP 5	25.59	7.76
GROUP 6	25.05	7.76

FOOTNOTE:

Laborers working off or with or from bos'n chairs, swinging scaffolds, belts (not applicable to workers entitled to receive the wage rate set forth in Group 1-a): \$0.25 per hour additional.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Masonry and plasterer tender; Cast-in-place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and buckler; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2" or over, 100 lbs. pressure/over); Hydro seeder and similar type; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull

float in connection with laborers' work; Vibrator

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive \$4.00 per day above Group 1 wage rates. "Sewer cleaner" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer manholes shall receive \$5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds. All employees performing work covered herein shall receive \$.25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shotcrete

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: All clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner

(jobsite only). The classification "material cleaner" is to be utilized under the following conditions:

- A: at demolition site for the salvage of the material.
- B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.
- C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of "form stripping, cleaning and oiling and moving to the next point of erection".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural nozzle operator

GROUP 2: Nozzle operator (including gun person, pot person); Rod person; Ground person

GROUP 3: Rebound person

GROUP 4: Guniting laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

GROUP 3: General laborer (includes all clean-up work, loading lumber, loading and burning of debris)

TUNNEL AND SHAFT LABORER CLASSIFICATIONS

GROUP 1: Diamond driller; Ground person; Guniting and shotcrete nozzle operator

GROUP 2: Rod person; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powder person - heading; Cherry picker operator - where car is lifted; Concrete finisher in tunnel; Concrete screed person; Grout pump operator and pot person; Guniting & shotcrete gun person & pot person; Header person; High pressure nozzle operator; Miner - tunnel, including top and bottom person on shaft and raise work; Nipper; Nozzle operator on slick line; Sandblaster - pot person

GROUP 4: Steel form raiser and setter; Timber person, retimber person (wood or steel or substitute materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powder person - primer house

GROUP 5: Vibrator operator, pavement breaker; Bull gang - muckers, track person; Concrete crew - includes rodding and spreading

GROUP 6: Dump person (any method); Grout crew; Rebound person; Swamper

* LABO0067I 06/26/2000

	Rates	Fringes
ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NAPA, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SOLANO, SONOMA, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES:		

LABORERS:

Construction specialist group	21.86	7.76
GROUP 1	21.16	7.76
GROUP 1-a	21.38	7.76
GROUP 1-b: see note below		

GROUP 1-c	21.21	7.76
GROUP 1-d: see note below		
GROUP 1-e	21.71	7.76
GROUP 1-f	21.74	7.76
GROUP 2	21.01	7.76
GROUP 3	20.91	7.76
GROUP 4	14.60	7.76

See groups 1-b and 1-d under laborer classifications.

GUNITE LABORERS:

GROUP 1	22.12	7.76
GROUP 2	21.62	7.76
GROUP 3	21.03	7.76
GROUP 4	20.91	7.76

WRECKING WORK:

GROUP 1	21.16	7.76
GROUP 2	21.01	7.76
GROUP 3	14.60	7.76

GARDENERS, HORTICULTURAL AND LANDSCAPE

LABORERS:

New construction	21.91	7.76
Establishment warranty period	14.60	7.76

TUNNEL AND SHAFT LABORERS:

GROUP 1	26.52	7.76
GROUP 2	26.29	7.76
GROUP 3	26.04	7.76
GROUP 4	25.77	7.76
GROUP 5	25.59	7.76
GROUP 6	25.05	7.76

FOOTNOTE:

Laborers working off or with or from bos'n chairs, swinging scaffolds, belts (not applicable to workers entitled to receive the wage rate set forth in Group 1-a): \$0.25 per hour additional.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Masonry and plasterer tender; Cast-in-place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and buckler; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2" or over, 100 lbs. pressure/over); Hydro seeder and similar ype; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids;

Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive \$4.00 per day above Group 1 wage rates. "Sewer cleaner" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer manholes, shall receive \$5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds (underground structures). All employees performing work covered herein shall receive \$.25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shotcrete

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not

listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches
 GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: All clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification "material cleaner" is to be utilized under the following conditions:

A: at demolition site for the salvage of the material.

B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.

C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of "form stripping, cleaning and oiling and moving to the next point of erection".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural nozzle operator

GROUP 2: Nozzle operator (including gun, pot); Ground person

GROUP 3: Rebound

GROUP 4: Guniting laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

GROUP 3: General laborer (includes all clean-up work, loading lumber, loading and burning of debris)

TUNNEL AND SHAFT LABORER CLASSIFICATIONS

GROUP 1: Diamond driller; Ground person; Guniting and shotcrete nozzle operator

GROUP 2: Rod person; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powder person - heading; Cherry picker operator - where car is lifted; Concrete finisher in tunnel; Concrete screed person; Grout pump operator and pot person; Guniting & shotcrete gun person & pot person; Header person; High pressure nozzle operator; Miner - tunnel, including top and bottom person on shaft and raise work; Nipper; Nozzle operator on slick line; Sandblaster - pot person

GROUP 4: Steel form raiser and setter; Timber person, retimber person (wood or steel or substitute materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powder person - primer house

GROUP 5: Vibrator operator, pavement breaker; Bull gang - muckers, track person; Concrete crew - includes rodding and spreading

GROUP 6: Dump person (any method); Grout crew; Rebound person; Swamper

LABO0073A 01/01/2001

	Rates	Fringes
ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MARIN, MODOC, NAPA, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SOLANO, SONOMA, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES:		
PLASTERER TENDER	21.10	8.25

LABO0139B 07/01/2000

	Rates	Fringes
NAPA, SOLANO AND SONOMA COUNTIES:		
BRICK TENDER	23.84	5.31

FOOTNOTE:

Refractory work where heat-protective clothing is required:
\$2.00 per hour additional.

LABO0185C 07/01/2000

	Rates	Fringes
ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES:		
BRICK TENDER	23.24	5.31

FOOTNOTE:

Refractory work where heat-protective clothing is required:
\$2.00 per hour additional.

LABO0291A 07/01/2000

	Rates	Fringes
MARIN COUNTY:		
BRICK TENDER	24.84	5.31

FOOTNOTE:

Refractory work where heat-protective clothing is required:
\$2.00 per hour additional.

PAIN0008F 07/01/1999

	Rates	Fringes
MARIN COUNTY:		
PAINTERS:		
General contracts of \$7 million and under	20.75	6.85
General contracts over \$7 million	23.36	6.85

PAIN0008J 07/01/1999

	Rates	Fringes
SONOMA COUNTY:		
PAINTERS:		
General contracts of \$7 million and under	20.50	6.85
General contracts over \$7 million,	24.11	6.85

* PAIN0012D 01/01/2001

	Rates	Fringes
MARIN, NAPA, SOLANO AND SONOMA COUNTIES:		
SOFT FLOOR LAYER	29.00	11.25

PAIN0016D 07/01/2000

	Rates	Fringes
NAPA AND SOLANO COUNTIES:		
PAINTERS:		
Brush and Roller	23.85	9.94
Industrial	24.10	9.94
Industrial Sandblast/Spray	24.10	9.94
Spray/Blasting	24.10	9.94
Spray Exotic Materials	24.10	9.94

PAIN0016E 08/01/1999

	Rates	Fringes
BUTTE AND COLUSA COUNTIES; GLENN COUNTY; LASSEN COUNTY (west of Hwy. 395, excluding Honey Lake); MARIN, MODOC AND NAPA COUNTIES; PLUMAS AND SHASTA COUNTIES; SISKIYOU, SOLANO, SONOMA, SUTTER, TEHAMA, TRINITY AND YUBA COUNTIES; EL DORADO COUNTY (west of the Sierra Nevada Mountains); NEVADA COUNTY (west of the Sierra Nevada Mountains); PLACER COUNTY (west of the Sierra Nevada Mountains); SACRAMENTO COUNTY; SIERRA COUNTY (west of the Sierra Nevada Mountains); AND YOLO COUNTY		
DRYWALL FINISHER:		
Remodel/tenant improvement work (shopping centers, offices and warehouses where the taping contractor is working directly for the tenant	22.38	8.28
All other work	28.08	9.98

FOOTNOTE:

Clean-up work (limited to clean-up, erection of interior OSHA approved scaffolding, masking, truck and forklift driving, stocking of taping materials, and sanding: 40% of the journeyman rate.

PAIN0016G 01/01/2000

	Rates	Fringes
BUTTE AND COLUSA COUNTIES; EL DORADO COUNTY (west of the Sierra Nevada Mountains); GLENN COUNTY; LASSEN COUNTY (west of Highway 395, excluding Honey Lake); MODOC COUNTY; NEVADA COUNTY (west of the Sierra Nevada Mountains); PLACER COUNTY (west of the Sierra Nevada Mountains); PLUMAS, SACRAMENTO AND SHASTA COUNTIES; SIERRA COUNTY (west of the Sierra Nevada Mountains); SISKIYOU, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES:		
PAINTERS:		
Brush, Pot Tender, Roller	23.10	9.94
Sandblaster, Spray, Structural Steel; Swing stage	24.10	9.94

PAIN0016P 03/01/1999

	Rates	Fringes
ALPINE COUNTY:		
DRYWALL TAPER	18.85	7.23
PAINTERS:		
Brush	18.05	7.23
Sandblaster; Waterblaster;		
Steam cleaning	19.05	7.23
Work with coal tar and exotic		

materials	19.80	7.23
-----------	-------	------

FOOTNOTES:

High time:

Steel construction workers working on erected steel construction, bridges, stacks, towers, tanks and similar structures, from 50 to 100 ft. above ground or water level: to be paid 1/2 hr. per day additional.

Work on such structures from 100 to 180 ft. above ground or water level: to be paid 1 hr. additional.

Work on such structures over 180 ft. above ground or water level: to be paid 2 hrs. per day additional.

Water level is defined as mean water level.

Exterior stage:

Work on exterior stage 4-7 stories: to be paid 1/2 hr. per day additional.

Work on exterior stage 8-11 stories: to be paid 1 hr. per day additional.

Work on exterior stage 12 stories or higher: to be paid 1-1/2 hrs. per day additional.

One story equals 10 ft.

PAIN0169D 07/01/2000

	Rates	Fringes
NAPA COUNTY; SOLANO COUNTY (west of a line defined as follows: Hwy. 80 corridor beginning at the City of Fairfield, including Travis Air Force Base and Suisun City; going north of Manakas Corner Rd., continue north on Suisun Valley Rd. to the Napa County line; Hwy. 80 corridor south on Grizzly Island Rd. to the Grizzly Island Management area):		
GLAZIER	29.35	9.91

PAIN0169H 07/01/2000

	Rates	Fringes
NAPA COUNTY; SOLANO COUNTY (west of a line defined as follows: Hwy. 80 corridor beginning at the City of Fairfield, including Travis Air Force Base and Suisun City; going north of Manakas Corner Rd., continue north on Suisun Valley Rd. to the Napa County line; Hwy. 80 corridor south on Grizzly Island Rd. to the Grizzly Island Management area):		
SHOWER DOOR INSTALLER	23.57	4.60

PAID HOLIDAYS:

New Year's Day, President's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Day after Thanksgiving, and Christmas Day.

PAIN0567A 10/01/1999

	Rates	Fringes
EL DORADO COUNTY (east of the Sierra Nevada Mountains); LASSEN COUNTY (east of Highway 395, beginning at Stacey and including Honey Lake); NEVADA COUNTY (east of the Sierra Nevada Mountains); PLACER COUNTY (east of the Sierra Nevada Mountains); AND SIERRA COUNTY (east of the Sierra Nevada Mountains):		
DRYWALL TAPERS:		

Taper	21.28	4.36
-------	-------	------

Steeplejack - taper, over 40 ft. with open space below	22.78	4.36
---	-------	------

PAINTERS:

Brush and roller	20.03	4.36
Sandblaster; Special coating application - brush	20.53	4.36
Spray; Paperhanger	20.78	4.36
Structural steel & steeplejack, 40 ft. open space below (does not include stairways, tube steel, Q-decks, and trust joints worked off power lift in enclosed buildings); Special coating application - spray	20.73	4.36
Special coating application - spray steel	21.28	4.36
Swing stage	22.03	4.36

FOOTNOTE:

A special coating is a coating that requires the mixing of 2 or more products.

PAIN0567H 07/01/2000

	Rates	Fringes
EL DORADO COUNTY (east of the Sierra Nevada Mountains); LASSEN COUNTY (east of Highway 395, beginning at Stacey and including Honey Lake); NEVADA COUNTY (east of the Sierra Nevada Mountains); PLACER COUNTY (east of the Sierra Nevada Mountains) AND SIERRA COUNTY (east of the Sierra Nevada Mountains):		
SOFT FLOOR LAYER	20.00	4.10

PAIN0718A 07/01/1999

	Rates	Fringes
MARIN AND SONOMA COUNTIES:		
GLAZIER	28.17	9.89

PAIN0767F 07/01/2000

	Rates	Fringes
ALPINE, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA AND SISKIYOU COUNTIES; SOLANO COUNTY (east of a line defined as follows: Hwy. 80 corridor beginning at the City of Fairfield, including Travis Air Force Base and Suisun City; going north of Manakas Corner Rd., continue north on Suisun Valley Rd. to the Napa County line; Hwy. 80 corridor south on Grizzly Island Rd. to the Grizzly Island Management area); SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES:		
GLAZIER	26.77	8.41

PAID HOLIDAYS:

New Year's Day, Washington's Birthday, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Day after Thanksgiving Day, and Christmas Day.

FOOTNOTE:

Work thirty (30) feet or over free fall: \$0.60 per hour additional.

PAIN1176A 06/26/2000

	Rates	Fringes
PARKING LOT STRIPING/HIGHWAY MARKING:		

GROUP 1	22.84	6.91
GROUP 2	22.45	6.91
GROUP 3	19.51	6.91
GROUP 4	22.15	6.91
Service Person (maintenance and repair of equipment)	13.33	5.87
Parking Lot, Game Court and Playground Installer	19.51	6.91
PARKING LOT STRIPING / HIGHWAY MARKING CLASSIFICATIONS		
GROUP 1: STRIPER: Layout and application of painted traffic stripes and marking; hot thermo plastic; tape traffic stripes and markings		
GROUP 2: TRAFFIC DELINEATING DEVICE APPLICATOR: Layout and application of pavement markers, delineating signs, rumble and traffic bars, adhesives, guide markers, other traffic delineating devices; includes all related surface preparation (sandblasting, waterblasting, grinding) as part of the application process		
GROUP 3: TRAFFIC SURFACE ABRASIVE BLASTER: Removal of traffic lines and markings; preparation of surface for coatings and traffic control devices		
GROUP 4: TRAFFIC PROTECTIVE DELINEATING SYSTEMS INSTALLER: Removes, relocates, installs permanently affixed roadside and parking delineation barricades, fencing, guard rail, cable anchor, retaining walls, reference signs, and monument markers		
GROUP 5: TRAFFIC CONTROLPERSON: Sole function is to control and direct traffic through both conventional and moving lane closures		

PAIN1237A 06/01/1999

	Rates	Fringes
ALPINE, BUTTE AND COLUSA COUNTIES; EL DORADO COUNTY (west of the Sierra Nevada Mountains); GLENN COUNTY; LASSEN COUNTY (west of Highway 395, beginning at Stacey and including Honey Lake); MODOC COUNTY; NEVADA COUNTY (west of the Sierra Nevada Mountains); PLACER COUNTY (west of the Sierra Nevada Mountains); PLUMAS, SACRAMENTO AND SHASTA COUNTIES; SIERRA COUNTY (west of the Sierra Nevada Mountains); SISKIYOU, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES:		
SOFT FLOOR LAYER	20.57	9.10

PLAS0001D 06/28/1999

	Rates	Fringes
CEMENT MASONS:		
Cement mason	22.35	9.46
Swing or slip form scaffolds; Mastic, magnesite, gypsum, epoxy, polyester, resin and all composition	23.10	9.46

PLAS0300C 07/01/2000

	Rates	Fringes
PLASTERER	23.76	8.50

PLUM0036F 01/01/2001

	Rates	Fringes
ALPINE COUNTY; AMADOR COUNTY (south of the San Joaquin River); BUTTE, COLUSA, GLENN, LASSEN, MODOC, PLUMAS, SHASTA, SIERRA,		

SISKIYOU, SUTTER, TEHAMA, TRINITY AND YUBA COUNTIES:

PLUMBER	27.79	9.19
---------	-------	------

PLUM0038B 07/01/1998

Rates

Fringes

MARIN AND SONOMA COUNTIES:

PLUMBERS:

Work on structures 5 stories
or less except for new
additions or remodel of
prisons or waste water
treatment plants

27.04

12.86

All other work

36.05

13.93

LANDSCAPE/IRRIGATION FITTER

27.32

10.60

PLUM0343A 07/01/2000

Rates

Fringes

NAPA AND SOLANO COUNTIES:

PLUMBER AND STEAMFITTER:

Work on condominiums and apartment
houses which are over 4 stories;
office buildings, schools, and
other commercial structures for
which the total plumbing bid
does not exceed \$250,000. Any
project bid in phases shall not
qualify unless the total project
is less than \$250,000 for the
plumbing bid and \$250,000 for the
heating and cooling bid.

Regardless of project size,
hospitals, jails, institutions
and industrial projects are not
included.

24.75

11.19

All other work

32.50

12.94

FOOTNOTES:

While welding or fitting galvanized material: \$.75 per hour
additional.

Work from trusses, temporary staging, unguarded structures 35'
from the ground or water: \$.75 per hour additional.

Work from swinging scaffolds, boatswains chairs or similar
devices: \$.75 per hour additional.

PLUM0350A 02/01/2001

Rates

Fringes

EL DORADO COUNTY (Lake Tahoe area only); NEVADA COUNTY (Lake
Tahoe area only); AND PLACER COUNTY (Lake Tahoe area only):

PLUMBER/PIPEFITTER

23.45

5.75

PLUM0355A 07/01/2000

Rates

Fringes

ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC,
NAPA, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA,
SISKIYOU, SOLANO, SUTTER, TEHAMA, TRINITY, YOLO, AND YUBA
COUNTIES

LANDSCAPE FITTER; UNDERGROUND UTILITY

WORKER	22.00	5.55

PLUM0447A 07/01/2000		
	Rates	Fringes
EL DORADO COUNTY (does not include Lake Tahoe area); NEVADA COUNTY (does not include Lake Tahoe area); PLACER COUNTY (does not include Lake Tahoe area); SACRAMENTO AND YOLO COUNTIES:		
PLUMBER and PIPEFITTERS	29.97	10.25

PLUM0447B 07/01/2000		
	Rates	Fringes
AMADOR COUNTY (north of the San Joaquin River):		
HEAVY AND HIGHWAY CONSTRUCTION:		
PLUMBER; PIPEFITTER	29.97	10.25

ROOF0081G 08/01/2000		
	Rates	Fringes
MARIN, NAPA, SOLANO AND SONOMA COUNTIES:		
ROOFER	22.80	9.85

ROOF0081H 09/01/1999		
	Rates	Fringes
ALPINE, ALPINE, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SUTTER, TEHAMA, TRINITY, YOLO, AND YUBA COUNTIES:		
ROOFER	18.26	10.03

SFCA0483C 01/01/2001		
	Rates	Fringes
MARIN, NAPA, SOLANO AND SONOMA COUNTIES:		
SPRINKLER FITTER (FIRE)	35.59	11.20

SFCA0669C 04/01/2000		
	Rates	Fringes
ALPINE, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES:		
SPRINKLER FITTER (FIRE)	27.35	5.95

SHEE0104C 07/01/2000		
	Rates	Fringes
TRINITY COUNTY:		
SHEET METAL WORKER (does not include metal deck and siding):		
Work on multiple family housing units over 4 stories where each individual family apartment is individually conditioned by a separate and independent unit or system; Also, work on any structure other than multiple family housing units, with a total HVAC and architectural sheet metal price of \$125,000		

or less	16.36	5.33
All other work	21.71	9.39

SHEE0104F 07/01/2000		
	Rates	Fringes
MARIN, NAPA, SOLANO AND SONOMA COUNTIES:		
SHEET METAL WORKER :		
Work on tenant completion		
projects providing the		
contract price is \$220,000 or		
less; remodel or add-on		
contracts on existing		
facilities providing the		
contract price is \$220,000		
or less; architectural sheet		
metal work of \$100,000 or less;		
pre-engineered and		
pre-manufactured siding	31.85	12.06
All other work	37.36	12.81

SHEE0104N 07/01/1999		
	Rates	Fringes
MARIN, NAPA, SOLANO, SONOMA AND TRINITY COUNTIES:		
SHEET METAL WORKER:		
Metal deck and siding	27.44	11.80

SHEE0104S 07/01/2000		
	Rates	Fringes
AMADOR, COLUSA, EL DORADO, NEVADA, PLACER, SACRAMENTO, SUTTER,		
YOLO AND YUBA COUNTIES:		
SHEET METAL WORKER:		
Metal deck and siding	28.44	12.05

SHEE0162F 07/01/2000		
	Rates	Fringes
AMADOR, COLUSA, EL DORADO, NEVADA, PLACER, SACRAMENTO, SUTTER,		
YOLO AND YUBA COUNTIES:		
SHEET METAL WORKER (does not include		
metal deck and siding)	30.16	10.450

SHEE0162G 01/01/2001		
	Rates	Fringes
ALPINE COUNTY:		
SHEET METAL WORKER:	26.14	10.26

SHEE0162H 07/01/1999		
	Rates	Fringes
AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC,		
NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU,		
SUTTER, TEHAMA, YOLO AND YUBA COUNTIES:		
SHEET METAL WORKER:		
Metal deck and siding	30.16	10.50

SHEE0162N 07/01/2000		
	Rates	Fringes
BUTTE, GLENN, LASSEN, MODOC, PLUMAS, SHASTA, SIERRA, SISKIYOU AND		

TEHAMA COUNTIES:

SHEET METAL WORKER:	24.13	10.50
---------------------	-------	-------

SUCA1002A 07/01/1985

	Rates	Fringes
AMADOR COUNTY:		
BUILDING CONSTRUCTION:		
BOILERMAKERS:		
Boilermaker	21.60	4.25
Boilermaker - blacksmith (storage tank erection)	17.25	4.00
Boilermaker - blacksmith (storage tank repair)	16.05	4.00
BRICKLAYER; STONEMASON	17.57	4.04
BRICK TENDER	13.80	3.46
CARPENTERS:		
Carpenter	18.58	6.455
Hardwood floorlayer; Power saw operator; Saw filer; Shingler; Steel scaffold erector and steel shoring	18.73	6.455
Millwright	19.48	7.855
Piledriver, bridge, wharf and dock builder	19.38	9.715
CEMENT MASONS:		
Cement mason	16.91	6.18
Swing or slip form scaffolds; Mastic, magnesite, gypsum, epoxy, polyester, resin and all composition	17.16	6.18
DRYWALL INSTALLERS/LATHERS:		
Drywall installer/lather	18.14	6.485
Drywall stocker, scrapper & clean-up	9.07	3.335
ELECTRICIANS:		
Electrician	16.30	3% + 3.38
Cable splicer	17.93	3% + 3.38
Residential electrician	12.50	3.30
Sound and signal technician	15.15	1.50
ELEVATOR CONSTRUCTOR	29.39	3.29 + a
GLAZIER	15.75	6.44
INSULATOR/ASBESTOS WORKER		
Includes the application of all insulating materials, protective coverings, coatings, and finishings to all types of mechanical systems	23.85	5.61
IRONWORKERS:		
Fence erector	18.01	8.93
Ornamental, reinforcing and structural	18.90	8.93
MARBLE FINISHER	13.92	3.67
MARBLE SETTER AND TERRAZZO WORKER	17.57	4.04
PAINTERS:		
Brush	13.39	4.60
Spray	14.14	4.60
Sandblaster; Scaffold;		

Sheetrock; Structural		
steel; Swing stage; Taper	13.79	4.60
PARKING LOT STRIPING WORK AND/OR		
HIGHWAY MARKERS:		
Traffic delineating device		
applicator	14.83	2.00 + b
Sandblaster; Striper; Wheel		
stop installer	14.30	2.00 + b
Slurry seal operation:		
Applicator operation;		
Shuttle; Squeegee	12.37	2.00 + b
Compactor, top, traffic		
control, service and		
spreader	10.39	2.00 + b
Mixer operator	13.95	2.00 + b
Traffic surface protective		
coating applicator	14.48	2.00 + b
PLASTERER	17.36	6.35
PLUMBER; STEAMFITTER:		
Amador County (northern half)	19.72	6.71
Amador County (southern half)	22.03	6.35
ROOFERS:		
Roofer (slate, tile and		
composition)	14.90	7.64
Enameler and pitch	17.65	7.64
SHEET METAL WORKER	18.37	12% + 5.06
SOFT FLOOR LAYER	16.01	3.00
SPRINKLER FITTER	21.87	3.23
TERRAZZO FINISHERS:		
Base machine operator	16.72	3.95
Terrazzo finisher	16.02	3.95
TILE SETTER	18.92	3.29
TILE FINISHER	10.68	1.65
LABORERS:		
GROUP 1	12.11	5.36
GROUP 1-a	12.31	5.36
GROUP 1-b	*	5.36
GROUP 1-c	12.16	5.36
GROUP 1-d	12.36	5.36
GROUP 1-e	12.59	5.36
GROUP 1-f	12.62	5.36
GROUP 2	11.98	5.36
GROUP 3	11.88	5.36
GROUP 4	8.46	5.36
GUNITE LABORERS:		
GROUP 1	12.52	5.36
GROUP 2	12.00	5.36
GROUP 3	11.88	5.36
WRECKING WORK:		
GROUP 1	12.11	5.36
GROUP 2	11.98	5.36
GROUP 3	11.88	5.36
*See Group 1-b under the group descriptions.		
POWER EQUIPMENT OPERATORS:		
Area 1:		
GROUP 1-a	11.76	9.60

GROUP 1	15.54	9.60
GROUP 2	16.09	9.60
GROUP 3	16.42	9.60
GROUP 4	17.27	9.60
GROUP 5	17.60	9.60
GROUP 6	17.83	9.60
GROUP 7	18.08	9.60
GROUP 8	18.76	9.60
GROUP 9	19.10	9.60
GROUP 10	19.45	9.60
GROUP 10-a	19.64	9.60
GROUP 11	19.91	9.60
GROUP 11-a	21.71	9.60
GROUP 11-b	22.14	9.60
GROUP 11-c	22.65	9.60
Area 2:		
GROUP 1-a	13.76	9.60
GROUP 1	17.54	9.60
GROUP 2	18.09	9.60
GROUP 3	18.42	9.60
GROUP 4	19.27	9.60
GROUP 5	19.60	9.60
GROUP 6	19.83	9.60
GROUP 7	20.08	9.60
GROUP 8	20.76	9.60
GROUP 9	21.10	9.60
GROUP 10	21.45	9.60
GROUP 10-a	21.64	9.60
GROUP 11	21.91	9.60
GROUP 11-a	23.71	9.60
GROUP 11-b	24.14	9.60
GROUP 11-c	24.65	9.60
TRUCK DRIVERS:		
GROUP 1	16.80	7.04
GROUP 2	16.88	7.04
GROUP 3	16.90	7.04
GROUP 4	16.91	7.04
GROUP 5	16.92	7.04
GROUP 6	16.93	7.04
GROUP 7	16.95	7.04
GROUP 8	16.97	7.04
GROUP 9	16.98	7.04
GROUP 10	17.00	7.04
GROUP 11	17.01	7.04
GROUP 12	17.05	7.04
GROUP 13	17.06	7.04
GROUP 14	17.07	7.04
GROUP 15	17.10	7.04
GROUP 16	17.11	7.04
GROUP 17	17.12	7.04
GROUP 18	17.14	7.04
GROUP 19	17.15	7.04
GROUP 20	17.16	7.04
GROUP 21	17.21	7.04
GROUP 22	17.24	7.04
GROUP 23	17.25	7.04

GROUP 24	17.34	7.04
GROUP 25	17.35	7.04
GROUP 26	17.38	7.04
GROUP 27	17.40	7.04
GROUP 28	17.44	7.04
GROUP 29	17.45	7.04
GROUP 30	17.48	7.04
GROUP 31	17.54	7.04
GROUP 32	17.47	7.04
GROUP 33	17.69	7.04
GROUP 34	17.79	7.04
GROUP 35	17.84	7.04
GROUP 36	17.99	7.04
GROUP 37	18.14	7.04

FOOTNOTES:

a. Vacation Pay: 8% with 5 or more years of service, 6% for 6 months to 5 years service. Paid Holidays: New Years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Friday after, and Christmas Day.

b. Employer contributes \$.80 per hour to vacation fund for the first year of employment; 1 year but less than 5 years, 1.13 per hour to vacation fund; 5 years but less than 10 years, 1.48 per hour to vacation fund; over 10 years 1.83 per hour to vacation fund.

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt ironer and raker; Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Chainsaw, faller, logloader and bucket; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete saw; Concrete sander; Cribber and/or shoring; Cut granite curb setter; Form raiser; Slip form; Green Cutter, headerboard, hubsetter, aligner; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactors; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials; Lagging, sheeting, whaling, bracing, trenchjacking, handguided lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); Perma curb; Precast-manhole setter; Cast-in-place manhole form setter; Pressure pipe tester; Pavement breaker and spader, including tool grinder; Pipelayer, caulker, bander, pipewrapper, conduit layer, plastic pipelayer, post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry); Rotary Scarifier, multiple head concrete chipper; Davis trencher, 300 or similar type (and all small trenchers); Roto and Ditch Witch; Roto-tiller; Sandblaster, pot, gun, nozzle operator; Signalling and rigging; Tank cleaner; Tree climber; Vibrascreed, bull float in connection with laborers' work; Vibrator; Dri-pak-it machine; High pressure blow pipe (1-1/2-inch. or over, 100 lbs. pressure and over); Hydro seeder and similar type; Laser beam in connection with laborers' work

GROUP 1-a: Joy drill model TWM-2A; Gardener-Denver model DH143 and similar type drills; Track drilller; Jack leg drilller; Diamond drilller; Wagon drilller; Mechanical drillers, all types

regardless of type or method of power; Multiple unit drill; Blaster and powder; All work or loading, placing and blasting of all power and explosives of whatever type regardless of method used for such loading and placing; High scaler (including drilling of same); Tree toppler; Bit grinder

GROUP 1-b: Sewer cleaner receives an additional \$4.00 per day; \$5.00 per day on recently active large diameter sewers or sewer manholes

GROUP 1-c: Burning and welding in connection with laborers' work

GROUP 1-d: Repair track and road beds (cut and cover work of subway after the temporary cover has been placed)

GROUP 1-e: Laborer on general construction work on or in bell hole footings and shaft

GROUP 1-f: Wire winding machine in connection with guniting or shotcrete-aligner

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and digger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Chuck tender; High pressure nozzle operator, adductor; Grout-crew; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Singlefoot, hand held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe under 12 inches

GROUP 3: All clean-up work of debris, grounds and buildings including but not limited to street cleaner; Cleaning and washing windows; Construction laborers including bridge and general laborer; Dump; Load spotter; Fire watcher; Street cleaner; Gardener, horticultural and landscape laborer; Jetting; Limber; Brush loader; Piler, maintenance landscape laborer on new construction; Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Fence erector; Guardrail erector; Pavement marker (button setter)

GROUP 4: Brick cleaner; Lumber cleaner

GUNITE CLASSIFICATIONS

GROUP 1: Nozzle operator (including gun, pot); Ground person

GROUP 2: Rebound person

GROUP 3: General laborer

WRECKING WORK CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows, doors, plumbing and electric fixtures)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

GROUP 3: General laborer (includes all clean-up work, loading lumber, loading and burning of debris)

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1-a: Landscape irrigation trencher, Davis trencher (300 or similar and all small trenchers including all trenching equipment with seats) capacity up to 3 ft. in depth

GROUP 1: Assistant to engineer (Brake; Fire tender; Heavy duty repair tender; Oiler; Deckhand; Signal; Switch; Tar pot fire tender)

GROUP 2: Compressor operator; Concrete mixer (up to and including 1 yd.); Conveyor belt operator (tunnel); Fire tender, hot plant; Hydraulic monitor; Mechanical conveyor (handling building materials); Mixer box operator (concrete plant); Pump operator; Spreader box (with screeds); Tar pot fire tender (power agitated)

GROUP 3: Box operator (bunker); Helicopter radio operator (signal); Motor operator; Locomotive (30 tons or under); Oiler; Ross Carrier (construction job site); Rotomist operator; Screed (except asphaltic concrete paving); Self-propelled, automatically applied concrete curing machine (on streets, highways, airports and canals); Trenching machine (maximum digging capacity 5 ft. depth); Tugger hoist, single drum; Truck crane oiler; Boiler tender

GROUP 4: Ballast jack tamper; Ballast regulation; Ballast tamper multipurpose; Box (asphalt plant); Elevator operator (inside); Fork lift or lumber stacker (construction job site); Line master; Material hoist (1 drum); Shuttlecar; Tie spacer; Towermobile

GROUP 5: Compressor operator (over 2); Concrete mixer (over 1 yd.); Concrete pump or pumpcrete gun; Generator; Grouting machine; Pressweld (air operated); Pumps (over 1); Welding machines (powered other than by electricity)

GROUP 6: BLH Lima road pactor or similar; Boom truck or dual-purpose A-frame truck; Concrete batch plant (wet or dry); Concrete saw (self-propelled unit) on streets, highways, airports and canals; Drilling and boring machinery, vertical and horizontal (not to apply to waterliners, wagon drills or jackhammers); Gradesetter, grade checker (mechanical or otherwise); Highline cableway signal; Locomotive (steam of over 30 tons); Maginnis internal full slab vibrator (on airports, highways, canals and warehouses); Mechanical finisher (concrete) (Clary, Johnson, Bidwell Bridge deck or similar types); Mechanical burm, curb and/or curb and gutter machine, concrete or asphalt; Portable crusher; Post driver (M-1500 and similar); Power jumbo operator (setting slip forms, etc., in tunnels); Roller (except asphalt); Screed (Barber-Greene and similar) (asphaltic concrete paving); Self-propelled compactor (single engine); Self-propelled pipeline wrapping machine, Perault, CRC, or similar types; Slip form pump (lifting device for concrete forms); Small rubber-tired tractor; Surface heater; Self-propelled power sweeper; Self-propelled tape machine; Auger-type drilling equipment, up to and including 30 ft. depth digging capacity m.r.c.

GROUP 7: Concrete conveyor or concrete pump, truck or equipment mounted (boom length to apply); Concrete conveyor, building site; Deck engineer; Dual drum mixer; Fuller Kenyon pump and similar types; Gantry rider (or similar); Hydra-hammer (or similar); Material hoist (2 or more drums); Mechanical finisher or spreader machine (asphalt, Barber-Greene and similar); Mine or shaft hoist; Mixermobile; Pavement breaker with or without compressor combination; Pipe bending machine (pipelines only); Pipe cleaning machine (tractor propelled and supported); Pipe wrapping machine (tractor propelled and supported); Refrigeration plant; Roller operator (finish asphalt); Self-propelled boom-type lifting device (center mount)

(10 tons or less m.r.c.); Self-propelled elevating grader plane; Slusher operator; Small tractor (with boom); Soil tester; Truck-type loader; Welding machine (gasoline or diesel)

GROUP 8: Armor-Coater (or similar); Asphalt plant engineer; Cast-in-place pipe laying machine; Combination slusher and motor operator; Concrete batch plant (multiple units); Dozer; Heading shield operator; Heavy-duty repair and/or welder; Ken Seal machine (or similar); Kolman loader; Loader (up to 2 yds.); Mechanical trench shield; Portable crushing and screening plant; Push cat; Rubber-tired earth-moving equipment (up to and including 45 cu. yds. "struck" m.r.c.) (Euclids, T-Pulls, DW-10, 20, 21 and similar); Rubber-tired dozer; Self-propelled compactor with dozer; Sheepfoot; Timber skidder (rubber-tired or similar equipment); Tractor-drawn scraper; Tractor; Trenching machine; Tri-batch paver; Tunnel mole boring machine; Woods-Mixer (and other similar Pugmill equipment)

GROUP 9: Canal finger drain digger; Chicago boom; Combination mixer and compressor (gunite); Combination slurry mixer and/or cleaner; Highline cable (5 tons and under); Lull Hi-lift or similar (20 ft. or over); Mucking machine (rubber-tired, rail or track type); Tractor (with boom) (D-6 or larger and similar)

GROUP 10: Boom-type backfilling machine; Bridge crane; Carry-lift (or similar); Chemical grouting machine, truck-mounted; Combination backhoe and loader (up to and including 1/2 cu. yd. m.r.c.); Derrick (2 operators required when swing engine remote from hoist); Derrick barge (except excavation work); Do-mor loader; Adams elegrader; Elevating grader; Heavy rotary drill rig (including caisson foundation work and Euclid loader and similar type); Robbins type drill; Koehring Skooper (or similar); Lift slab machine (Vagtborg and similar types); Loader (2 yds. up to and including 4 yds.); Locomotive, 100 tons (single or multiple units); Multiple engine earthmoving machine (Euclids, dozers, etc.) (no tandem scraper); Pre-stress wire wrapping machine; Reservoir-debris tug (self-propelled floating); Rubber-tired scraper, self-loading (paddle wheels, etc.); Shuttle car (reclaim station); Single-engine scraper over 45 yds.; Soil stabilizer (P & H or equal); Sub-grader (Gurrier or other automatic type); Tractor, compressor drill combination; Track-laying-type earthmoving machine (single engine with tandem scrapers); Train loading station; Trenching machine, multi-engine with sloping attachment, Jeffco or similar; Vacuum cooling plant; Whirley crane (up to and including 25 tons)

GROUP 10-a: Backhoe (hydraulic) (up to and including 1 cu. yd. m.r.c.); Backhoe (cable) (up to and including 1 cu. yd. m.r.c.); Combination backhoe and loader (over 3/4 cu. yd. m.r.c.); Continuous flight tie back auger (crane attached/separate controls); Crane not over 25 tons, Hammerhead and Gantry; Gradall (up to and including 1 cu. yd.); Power blade operator (single engine); Power shovel, clamshell, dragline (up to and including 1 cu. yd. m.r.c.) (long boom pay); Rubber-tired scraper, self-loading (Paddle Wheel, twin engine); Self-propelled boom-type lifting device (center mount); over 10 tons up to and including 25 tons); CMI dual land auto grader SP-30 or similar

GROUP 11: Automatic concrete slip-form paver (Gradesetter,

Screed); Automatic railroad car dumper; Canal trimmer with ditching attachment; Cary-lift, Campbell or similar; Continuous flight tie back auger (crane attached, single controls); Crane (over 25 tons up to and including 125 tons); Drott travelift 650-A-1 or similar (45 tons or over); Euclid loader when controlled from the Pullcat; Highline cableway (over 5 tons); Loader (over 4 cu. yds. up to and including 12 cu. yds.); Miller formless M-900 slope paver or similar (grade setter required); Multiple engine scraper (when used as Push Pull); Power blade operator (multi-engine); Power shovel, clamshell, dragline, backhoe, gradall (over 1 cu. yd. up to and including 7 cu. yds. m.r.c., long boom pay); Rubber-tired earthmoving machine (multiple propulsion power units and two or more scrapers) (up to and including 75 cu. yds. struck m.r.c.); Self-propelled compactor boom-type lifting device (center mount) (over 25 tons m.r.c.); Single engine rubber-tired earthmoving machine (with tandem scrapers); Slip form paver (concrete or asphalt) (screed required); Tandem cat; Tower crane mobile (including rail mounted); Trencher (pulling attached shield); Tower cranes, Universal Liebherr and similar types (in the erection, dismantling and moving of equipment); Wheel excavator (up to and including 750 cu. yds. per hour); Whirley crane (over 25 tons); Multi-earthmoving equipment (up to and including 75 cu. yds. "struck" m.r.c.); Truck-mounted hydraulic crane when remote control equipped (over 10 tons up to and including 25 tons)

GROUP 11-A: Band wagon (in conjunction with wheel excavator); Crane (over 125 tons); Loader (over 12 cu. yds. up to and including 18 cu. yds.); Power shovel, clamshell, backhoe, gradall and dragline (over 7 cu. yds. m.r.c.); Rubber-tired multi-purpose earthmoving machine (2 units over 75 cu. yds. "struck" m.r.c.); Wheel excavator (over 750 cu. yds. per hour)

GROUP 11-b: Loader (over 18 yds.)

GROUP 11-c: Operator of helicopter (when used in erection work); Remote-controlled earthmoving equipment

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1: Bulk cement spreader (with or without auger, under 4 yds. water level); Bus driver; Concrete pump machine; Concrete pump truck (when flat rack truck is used appropriate flat rack rate shall apply); Dump (under 4 yds. water level); Dumpcrete truck (under 4 yds. water level); Dumpster (under 4 yds. water level); Escort or pilot car driver; Nipper truck (when flat rack truck is used appropriate flat rack rate shall apply); Pickup; Skid (debris box, under 4 yds. water level); Team driver; Truck (dry pre-batch concrete mix, under 4 yds. water level)

GROUP 2: Teamster oiler and/or greaser and/or service person

GROUP 3: Bulk cement spreader (with or without auger, 4 yds. and under 6 yds. water level); Dump (4 yds. and under 6 yds. water level); Dumpcrete (4 yds. and under 6 yds. water level); Dumpster (4 yds. and under 6 yds. water level); Skid (debris box, 4 yds. and under 6 yds. water level); Single unit flat rack (2 axle unit); Industrial lift truck (mechanical tailgate); Truck (dry pre-batch concrete mix, 4 yds. and under 6 yds. water level)

GROUP 4: Jetting truck and water truck (under 2,500 gallons)

GROUP 5: Road oil truck or boot person

GROUP 6: Lift jitney, fork lift

GROUP 7: Transit mix, agitator (under 6 yds.)
GROUP 8: Fuel and/or grease truck driver or fuel
GROUP 9: Vacuum truck, under 3,500 gallons
GROUP 10: Scissor truck; Single unit flat rack (2 axle unit); Industrial lift truck (mechanical tailgate); Small rubber-tired tractor (when used within Teamsters' jurisdiction)
GROUP 11: Jetting truck and water trucks, 2,500 gallons and under 4,000 gallons
GROUP 12: Combination winch truck with hoist; Transit mix agitator (6 yds. and under 8 yds.)
GROUP 13: Vacuum truck, 3,500 gallons and under 5,500 gallons
GROUP 14: Rubber-tired muck car (not self-loaded)
GROUP 15: Bulk cement spreader (with or without auger, 6 yds. and under 8 yds. water level); Dump (6 yds. and under 8 yds. water level); Dumpcrete (6 yds. and under 8 yds. water level); Dumpster (6 yds. and under 8 yds. water level); Skid (debris box, 6 yds. and under 8 yds. water level); Truck (dry pre-batch concrete mix, 6 yds. and under 8 yds. water level)
GROUP 16: A-frame, winch truck; Buggymobile; Jetting and water truck (4,000 gallons and under 5,000 gallons); Rubber-tired jumbo
GROUP 17: Heavy-duty transport (high bed)
GROUP 18: Ross Hyster and similar straddle carrier
GROUP 19: Transit mix agitator (8 yds. through 10 yds.)
GROUP 20: Vacuum truck (5,500 gallons and under 7,500 gallons)
GROUP 21: Jetting truck and water truck (5,000 gallons and under 7,000 gallons)
GROUP 22: Combination boot person and road oiler
GROUP 23: Transit mix agitator (over 10 yds. through 12 yds.)
GROUP 24: Bulk cement spreader (with or without auger, 8 yds. and including 12 yds. water level); Dump (8 yds. and including 12 yds. water level); Dumpcrete (8 yds. and including 12 yds. water level); Self-propelled street sweeper with self-contained refuse bin; Skid (debris box, 8 yds. and including 12 yds. water level); Snow Go and/or snow plow; Truck (dry pre-batch concrete mix, 8 yds. and including 12 yds. water level)
GROUP 25: Heavy-duty transport (gooseneck lowbed)
GROUP 26: Transit mix agitator (over 12 yds. through 17 yds.)
GROUP 27: Ammonia nitrate distributor driver and mixer; Bulk cement spreader (with or without auger, over 12 yds. and including 18 yds. water level); Dump (over 12 yds. and including 18 yds. water level); Dumpcrete (over 12 yds. and including 18 yds. water level); Dumpster (over 12 yds. and including 18 yds. water level); Skid (debris box, over 12 yds. and including 18 yds. water level); Truck (dry pre-batch concrete mix, over 12 yds. and including 18 yds. water level)
GROUP 28: Double gooseneck (7 or more axles); Heavy-duty transport tiller
GROUP 29: P.B. or similar type self-loading truck
GROUP 30: Transit mix agitator (over 14 yds. through 16 yds.)
GROUP 31: Bulk cement spreader (with or without auger, over

18 yds. and including 24 yds. water level); Combination dump and dump trailer; Dump (over 18 yds. and including 24 yds. water level); Dumpcrete (over 18 yds. and including 24 yds. water level); Dumpster (over 18 yds. and including 24 yds. water level); Skid (debris box, over 18 yds. and including 24 yds. water level); Transit mix agitator (over 12 yds. through 16 yds.); Truck (dry pre-batch concrete mix, over 18 yds. and including 24 yds. water level)

GROUP 32: Bulk cement spreader (with or without auger, over 24 yds. and including 35 yds. water level); Dump (over 24 yds. and including 35 yds. water level); Dumpcrete (over 24 yds. and including 35 yds. water level); Dumpster (over 24 yds. and including 35 yds. water level); DW 10's, 20's, 21's and other similar Cat type, Terra Cobra, LeTournapulls, Tournarocker, Euclid and similar type equipment when pulling fuel and/or grease tank trailers or other miscellaneous trailers; Skid (debris box, over 24 yds. and including 35 yds. water level); Truck (dry pre-batch concrete mix, over 24 yds. and including 35 yds. water level)

GROUP 33: Truck repair person

GROUP 34: Bulk cement spreader (with or without auger, over 35 yds. and including 50 yds. water level); Dump (over 35 yds. and including 50 yds. water level); Dumpcrete (over 35 yds. and including 50 yds. water level); Dumpster (over 35 yds. and including 50 yds. water level); Skid (debris box, over 35 yds. and including 50 yds. water level); Truck (dry pre-batch concrete mix, over 35 yds. and including 50 yds. water level)

GROUP 35: DW 10's, 20's, 21's and other similar Cat type, Terra Cobra, LeTournapulls, Tournarocker, Euclid and similar type equipment when pulling Aqua/Pak or water tank trailers

GROUP 36: Bulk cement spreader (with or without auger, over 50 yds. and under 65 yds. water level); Dump (over 50 yds. and under 65 yds. water level); Dumpcrete (over 50 yds. and under 65 yds. water level); Dumpster (over 50 yds. and under 65 yds. water level); Helicopter pilot (when transporting workers or materials); Skid (debris box, over 50 yds. and under 65 yds. water level); Truck (dry pre-batch concrete mix, over 50 yds. and under 65 yds. water level)

GROUP 37: Bulk cement spreader (with or without auger, 65 yds. and including 80 yds. water level); Dump (65 yds. and including 80 yds. water level); Dumpcrete (65 yds. and including 80 yds. water level); Dumpster (65 yds. and including 80 yds. water level); Skid (debris box, 65 yds. and including 80 yds. water level); Truck (dry pre-batch concrete mix, 65 yds. and including 80 yds. water level)

GROUP 38: Bulk cement spreader (with or without auger, over 80 yds. and including 95 yds. water level); Dump (over 80 yds. and including 95 yds. water level); Dumpcrete (over 80 yds. and including 95 yds. water level); Dumpster (over 80 yds. and including 95 yds. water level); Skid (debris box, over 80 yds. and including 95 yds. water level); Truck (dry pre-batch concrete mix, over 80 yds. and including 95 yds. water level)

TEAM0094B 06/16/1999

Rates

Fringes

TRUCK DRIVERS:

GROUP 1	21.06	11.46
GROUP 2	21.36	11.46
GROUP 3	21.66	11.46
GROUP 4	22.01	11.46
GROUP 5	22.36	11.46

FOOTNOTES:

Articulated dump truck; Bulk cement spreader (with or without auger); Dumpcrete truck; Skid truck (debris box); Dry pre-batch concrete mix trucks; Dumpster or similar type; Slurry truck: Use dump truck yardage rate.

Heater planer; Asphalt burner; Scarifier burner; Industrial lift truck (mechanical tailgate); Utility and clean-up truck: Use appropriate rate for the power unit or the equipment utilized.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Dump trucks, under 6 yds.; Single unit flat rack (2-axle unit); Nipper truck (when flat rack truck is used appropriate flat rack shall apply); Concrete pump truck (when flat rack truck is used appropriate flat rack shall apply); Concrete pump machine; Fork lift and lift jitneys; Fuel and/or grease truck driver or fuelperson; Snow buggy; Steam cleaning; Bus or personhaul driver; Escort or pilot car driver; Pickup truck; Teamster oiler/greaser and/or serviceperson; Hook tender (including loading and unloading); Team driver; Tool room attendant (refineries)

GROUP 2: Dump trucks, 6 yds. and under 8 yds.; Transit mixers, through 10 yds.; Water trucks, under 7,000 gals.; Jetting trucks, under 7,000 gals.; Vacuum trucks, under 7,500 gals.; Single unit (flat rack 3-axle unit); Highbed heavy duty transport; Scissor truck; Rubber-tired muck car (not self-loaded); Rubber-tired truck, jumbo; Winch truck and "A" frame drivers; Combination winch truck with hoist; Road oil truck or bootperson; Buggymobile; Ross, Hyster and similar straddle carrier; Small rubber-tired tractor

GROUP 3: Dump trucks, 8 yds. and including 35 yds.; Transit mixers, over 10 yds.; Water trucks, 7,000 gals. and over; Jetting trucks, 7,000 gals. and over; Vacuum trucks, 7,500 gals. and over; Trucks towing tilt bed or flat bed pull trailers; Lowbed heavy duty transport; Heavy duty transport tiller person; Self-propelled street sweeper with self-contained refuse bin; Boom truck - hydro-lift or Swedish type extension or retracting crane; P.B. or similar type self-loading truck; Tire repairperson; Truck repairperson; Combination bootperson and road oiler; Dry distribution truck (A bootperson when employed on such equipment, shall receive the rate specified for the classification of road oil trucks or bootperson); Ammonia nitrate distributor, driver and mixer; Snow Go and/or plow

GROUP 4: Dump trucks, over 35 yds. and under 65 yds.; Water pulls - DW 10's, 20's, 21's and other similar equipment when pulling Aqua/pak or water tank trailers; Helicopter pilots (when transporting men or materials); DW10's, 20's, 21's and other similar Cat type, Terra Cobra, LeTourneau Pulls, Tournorocker, Euclid and similar type equipment when pulling fuel and/or grease tank trailers or other miscellaneous trailers

GROUP 5: Dump trucks, 65 yds. and over; Holland hauler

WELDERS - Receive rate prescribed for craft performing operation

to which welding is incidental.

=====

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(v)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

ATTACHMENTS

ATTACHMENTS

1. NOT APPLICABLE

2. SUBMISSION OF EFT INFORMATION TO THE PAYMENT OFFICE

The Payment Office for this contract will be the USACE Finance Center (UFC) in Millington, Tennessee. Payments under this contract will be made by Electronic Funds Transfer (EFT).

The Direct Deposit Authorization Form (UFC-DISB-4) necessary for the UFC to make an Electronic Funds Transfer to your account and instructions for completing this form are attached. In accordance with FAR 52.232-34, Payment by Electronic Funds Transfer~~B~~Other than Central Contractor Registration (see Section 00800), this form must be completed by the successful contractor and forwarded to the Payment Office at the following address: USACE Finance Center, ATTN: CEFC-AD (Attn: Lee Autry), 5720 Integrity Drive, Millington, TN 38054-5005. This form is available at the following website: www.fc.usace.army.mil. If you download this form, please be sure to add the Installation EROC code of AL2" for Sacramento District.

Further information regarding Electronic Funds Transfer is available at the following website: www.fms.treas.gov/eft/208agency.html.

3. PREAWARD SURVEY - SEE SECTION 00100, SAACONS 52.0209-4501. THE PREAWARD SURVEY IS ATTACHED FOR INFORMATION PURPOSES ONLY; IT WILL BE REQUIRED ONLY FROM THE LOW BIDDER AFTER BID OPENING IF THE LOW BIDDER HAS NOT HAD A CONTRACT WITH THE SACRAMENTO DISTRICT, CORPS OF ENGINEERS, IN THE LAST TWELVE-MONTH PERIOD. IT IS NOT REQUIRED AS PART OF THE BID PACKAGE.

4. SAMPLE SUBCONTRACTING PLAN - SEE SECTION 00100, SAACONS 52.0219-4581; SECTION 00800, FAR 52.219-9, AND SAACONS 52.0219-4509. THE SAMPLE SUBCONTRACTING PLAN IS ATTACHED FOR INFORMATION PURPOSES ONLY. A SUBCONTRACTING PLAN WILL BE REQUIRED ONLY FROM THE LOW BIDDER IF THE LOW BIDDER IS A LARGE BUSINESS AND THE LOW BID IS OVER \$1 MILLION. A SUBCONTRACTING PLAN IS NOT REQUIRED FROM SMALL BUSINESSES. THE SUBCONTRACTING PLAN IS NOT REQUIRED FROM THE LOW BIDDER UNTIL AFTER THE BID OPENING; IT IS NOT REQUIRED AS PART OF THE BID PACKAGE.

5. DRAWING LIST

6. CONTRACTOR PREPARED AS-BUILTS

ATTACHMENT NO. 1

NOT APPLICABLE

ATTACHMENT NO. 2

SUBMISSIONS OF EFT INFORMATION
TO THE PAYMENT OFFICE

DIRECT DEPOSIT AUTHORIZATION FORM

PRIVACY ACT STATEMENT

The following information is provided to comply with the Privacy Act of 1974 (P.L. 93-579). All information collected on this form is required under the provisions of 31 U.S.C. 3322 and 31 CFR 210. This information will be used by the Treasury Department to transmit data, by electronic means to vendor's financial institution. Failure to provide the requested information may delay or prevent the receipt of payments through the Automated Clearing House Payment System.

AUTHORIZATION

I hereby authorize U. S. Army Corps of Engineer, hereinafter called USACE, to initiate direct deposit credit entries to my (our) account indicated below and the financial institution named below, hereinafter called DEPOSITORY, to credit the same to such account

(1) **Check One of the following Statements:**

I am not currently participating in the Direct Deposit Program
() **ADD** - Deposit my payment to the account shown.

OR

I am currently participating in the Direct Deposit Program
() **CHANGE** - Change financial institutions and/or account number.

(2) **Installation EROC** ____ **L2** ____ (Sacramento District)

Name or (Company as shown on invoice): (3)		
Address: (4)		
City: (5)	State:	Zip:
Mailing Address (if different): (6)		
Daytime Phone: () (7)		

Contract # (Optional):

If more than one contract, please list on a separate sheet.

**Please ask your Financial Institution for your Depositor Account Number and Routing Number
(Indicate which type account to credit)**

Type of Depositor Account Please check a box.	<input type="checkbox"/>	Checking (8)	<input type="checkbox"/>	Saving (9)															
Depositor Account Number (10)																			

Name of Financial Institution: (11)									
Address: (12)									
City: (13)			State:				Zip:		
Routing Number: (14)									
Depositor Account Title: (15)									

Tax ID No. (TIN) for Business: (16)	
---	--

SIGNATURE: (17) _____ **DATE: (18)** _____

Mail To: USACE Finance Center, ATTN: EFT/DISB, 5720 Integrity Drive, Millington, TN 38054-5005

INSTRUCTIONS FOR COMPLETING FORM UFC-DISB-4

- 1. Vendors and/or travelers should indicate if this is an add as a new Direct Deposit to be set up or a change or cancellation. USACE employees already on payroll Direct Deposit who have not completed a travel form should mark ADD.**
- 2. Include the Corps of Engineers District name (example: Savannah) or EROC (example: K6) that wrote the contract authorizing payment. If more than one District issued contracts, prepare a separate form for each District.**
- 3. Include the name or Company as it appears on the invoice. If the contract was written to Bill and Betty Smith, the bill and Direct Deposit form should include both names not Bill Smith.**
- 4. This address should be the physical address of the business.**
- 5. The city and state that match the physical address.**
- 6. The mailing address should include any and all Remit to/payment addresses that are different from the physical address. (If more space is needed, include an attachment page with all addresses listed). This is VERY IMPORTANT since we load the routing and bank account number on each payment address.**
- 7. Include daytime phone number in case there are questions concerning the completed form.**
- 8. Check if the bank account number furnished is a checking account.**
- 9. Check if the bank account number furnished is a savings account.**
- 10. Include bank account number, one number in each slot. This number can be found on the front of the check.**
- 11. The full name of the bank for the account.**
- 12/13. An accurate address for the bank.**
- 14. The routing number for the bank. It is located on the face of the check. This is always a nine digit NUMBER. Enter one number in each space.**
- 15. Depositor account title is the name registered with the bank on the bank account.**
- 16. For businesses include the IRS tax ID number. For an individual use the social security number.**
- 17. Businesses should have a signature of an officer of the company. Individuals should sign. If the Direct Deposit form/contract is written in the name of Bill and Betty Smith, both individuals should sign.**
- 18. Date of the authorization.**

E X A M P L E DIRECT DEPOSIT AUTHORIZATION FORM E X A M P L E

I hereby authorized U. S. Army Corps of Engineer, hereinafter called USACE, to initiate direct deposit credit entries to my (our) account indicated below and the financial institution named below, hereinafter called DEPOSITORY, to credit the same to such account. This authority is to remain in full force and effect until USACE has received written notification from me (or either of us) of its termination in such time and in such manner as to afford USACE and DEPOSITORY a reasonable opportunity to act on it.

Check One: I am not currently participating in the Direct Deposit Program.

(1) () **ADD** - Deposit my payment to the account shown.

 I am currently participating in the Direct Deposit Program.

(2) Installation EROC ____ L2 ____

() **CHANGE** - Change financial institutions and/or account number.

(Sacramento District)

() **CANCEL** - Stop my participation in the program.

Name or (Company as shown on invoice): (3)		
Address: (4)		
City: (5)	State:	Zip:
Mailing Address (if different): (6)		
Daytime Phone: () (7)		

Please ask your Financial Institution for your Depositor Account Number and Routing Number
(Indicate which type account to credit)

Type of Depositor Account Please check a box.	8	Checking	9	Saving
Depositor Account Number (10)				

Name of Financial Institution: (11)									
Address: (12)									
City: (13)				State:			Zip:		
Routing Number: (14)									
Depositor Account Title: (15)									

Tax ID Number (TIN) for Business: (16)	
---	--

SIGNATURE:_(17)_____ **DATE:**_(18)_____

Mail To: USACE Finance Center, ATTN: CEFC-AD, 5720 Integrity Drive, Millington, TN 38054-5005

FORM: UFC-DISB-4

Attach 2/SAC

ATTACHMENT NO. 3

PREAWARD SURVEY

PREAWARD SURVEY OF PROSPECTIVE CONTRACTORS
CONSTRUCTION CONTRACTS

It is the general policy of the Department of Defense that contracts shall be awarded only to contractors determined to be responsible in accordance with Part 9 of the Federal Acquisition Regulation (FAR).

No contract shall be awarded to any person or firm unless the Contracting Officer first makes an affirmative determination that the prospective contractor is responsible within the meaning of the FAR, Part 9.

Before making a determination of responsibility, the Contracting Officer shall have in his/her possession or obtain information sufficient to satisfy himself/herself that a prospective contractor currently meets the minimum FAR Part 9 standards.

In order to make the required determination and also to expedite the contract award, the following information must be submitted by the Contractor as directed (see Section 00100, SAACONS 52.0209-4501):

- A. COMPLETED CONTRACTOR EXPERIENCE DATA FORM WITH SUPPLEMENTAL SCHEDULES A-D (ATTACHED).
- B. LATEST FINANCIAL STATEMENTS. IF THE FINANCIAL STATEMENT IS MORE THAN 60 DAYS OLD, SUBMIT A CERTIFICATE STATING THAT THE FIRM'S FINANCIAL CONDITION IS SUBSTANTIALLY THE SAME, OR, IF NOT THE SAME, STATE THE CHANGES THAT HAVE TAKEN PLACE.
- C. PROVIDE LETTERS FROM BANKS OR OTHER FINANCIAL INSTITUTIONS WITH WHICH THE CONTRACTOR CONDUCTS BUSINESS. THE LETTERS SHOULD CONTAIN INFORMATION ABOUT YOUR FIRM'S ACCOUNTS, LOANS, LINES OF CREDIT, ETC., PROVIDING INFORMATION LEADING TO A DETERMINATION THAT YOUR FIRM IS "RESPONSIBLE" AS DEFINED IN THE FEDERAL ACQUISITION REGULATION, PART 9, "HAS THE FINANCIAL RESOURCES TO PERFORM THE CONTRACT OR THE ABILITY TO OBTAIN THEM". THE GOVT IS INTERESTED IN FINANCIAL STABILITY, TIMELY PAYMENTS, THE LENGTH AND NATURE OF THE RELATIONSHIP BETWEEN THE FIRM AND THE FINANCIAL INSTITUTION, ETC. WHICH REVEALS THE FIRM'S FINANCIAL ABILITY TO PERFORM THE CONTRACT. THE LETTERS SHOULD ALSO PROVIDE THE NAME AND TELEPHONE NUMBER OF THE BANK REPRESENTATIVE THE GOVERNMENT MAY CONTACT.

BE SURE TO INCLUDE IN YOUR PREAWARD SURVEY, INFORMATION ON ANY CONTRACTS YOU HAVE HAD WITH THE SACRAMENTO DISTRICT OR LOS ANGELES DISTRICT, CORPS OF ENGINEERS, WITHIN THE LAST 12 MONTHS.

THESE DOCUMENTS SHALL BE TREATED BY THE GOVERNMENT AS CONFIDENTIAL.

CONSTRUCTION CONTRACTOR EXPERIENCE DATA		DATE (Day, Month, Year)	
1. FIRM NAME		2. MAIN OFFICE ADDRESS (Street, City, State and Telephone)	
3. BRANCH OFFICES		4. SERVICES RENDERED <input type="checkbox"/> CONSTRUCTION <input type="checkbox"/> DESIGN <input type="checkbox"/> CONSULTANT	
5. ORGANIZATION <input type="checkbox"/> INDIVIDUAL <input type="checkbox"/> JOINT VENTURE <input type="checkbox"/> PARTNERSHIP <input type="checkbox"/> CORPORATION		6. DATE ORGANIZED	7. DATE INCORPORATED AND STATE
8. NAMES OF OFFICERS AND OTHER KEY PERSONNEL			
I - PRESENT PAYROLL PERSONNEL (List Number of Each Category Below)			
PARTNERS	OFFICERS	OTHER KEY	REMAINDER TOTAL
		SUBTOTAL PERMANENT: MAXIMUM PERSONNEL AT ANY TIME	
		DATE	
II - EQUIPMENT OWNED		III - FINANCIAL DATA AS OF (Date)	
PRESENT VALUE (\$)	ACQUISITION COST (\$)	CURRENT ASSETS	CURRENT LIABILITIES
		NET WORTH	
IV - TOTAL CONTRACT VALUE OF CONSTRUCTION AND DEMOLITION IN PAST SIX YEARS EXCLUSIVE OF JOINT VENTURE		V - LARGEST JOB EVER CONTRACTED (If Other Than In Past Six Years)	
19	\$	LARGEST JOB IN PAST SIX YEARS	
19	\$	CONTRACT AMOUNT	DATE
19	\$	DESCRIPTION	
19	\$		
19	\$		
19	\$		
AVERAGE ANNUAL \$ INCOME		OWNER	
VI - TYPE OF WORK IN WHICH FIRM SPECIALIZES			
VII - TYPE OF WORK AND ACCEPTABLE LOCATIONS FOR WHICH FIRM DESIRES TO BE CONSIDERED			
VIII - COST-REIMBURSEMENT TYPE CONTRACTS			
AGENCY OR OWNER	DATE	DESCRIPTION	AMOUNT
TYPED NAME AND POSITION OR TITLE OF PERSON SIGNING		SIGNATURE	
NOTE: Use reverse side for remarks, explanations, or detailed description of items requested above.			

SCHEDULE A

CONSTRUCTION CONTRACTOR EXPERIENCE DATA

EXISTING COMMITMENTS: (List below the construction projects your firm has under way on this date, including those on which you are presently low bidder but have not received an award.)

CONTRACT NUMBER AND AMOUNT	DESCRIPTION OF WORK	FOR WHOM PERFORMED*	PERCENT COMPLETE	PERCENT SUBLET
-------------------------------	---------------------	---------------------	---------------------	-------------------

* PROVIDE NAME OF ORGANIZATION, POINT OF CONTACT AND TELEPHONE NUMBER FOR CONTACT.

SCHEDULE B

CONSTRUCTION CONTRACTOR EXPERIENCE DATA

EXPERIENCE DATA: (List below the principal construction projects your firm has completed within the past six (6) years.)

<u>CONTRACT NO.</u>	<u>AMOUNT</u>	<u>DESCRIPTION/LOCATION</u>	<u>CONTACT PERSON/PHONE NO</u>	<u>PERCENT SUBLET</u>
---------------------	---------------	-----------------------------	--------------------------------	---------------------------

SCHEDULE C

CONSTRUCTION CONTRACTOR EXPERIENCE DATA

CONSTRUCTION AND/OR TECHNICAL EQUIPMENT: (List total equipment and facilities owned for performing the work and present status as to whether or not it is committed to existing contracts.)

<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>CONDITION</u>	<u>YEARS OF SERVICE</u>	<u>PRESENT STATUS</u>
-----------------	--------------------	------------------	-----------------------------	---------------------------

SCHEDULE D

CONSTRUCTION CONTRACTOR EXPERIENCE DATA

TO BE COMPLETED IF PROPOSED MILITARY CONSTRUCTION CONTRACT EXCEEDS \$1,000,000.

A. Each contract awarded within the preceding three-month period exceeding \$1,000,000 in value with brief description of the contract:

B. Each contract awarded within the preceding three-year period not already physically completed and exceeding \$5,000,000 in value with brief description of the contract:

ATTACHMENT NO. 4
SUBCONTRACTING PLAN

- S A M P L E -

SUBCONTRACTING PLAN

SUBCONTRACTING PLAN SUBMITTED IN ACCORDANCE WITH PUBLIC LAW 95-507 (THE FOLLOWING FORMAT IS ESTABLISHED IN ACCORDANCE WITH FAR 52.219-9(d)(1) THROUGH (d)(11) AND INCLUDES THE REQUIRED STATUTORY ELEMENTS AS DESCRIBED IN FAR 19.704. IT ALSO INCLUDES ADDITIONAL REQUIREMENTS OF THE DFARS 219.704 AND AFARS 219.704. EVALUATION OF THE SUBCONTRACTING PLAN BY THE GOVERNMENT WILL BE AS PRESCRIBED IN FAR (AND ITS SUPPLEMENTS) 19.705.

DO NOT JUST ADDRESS THE FOLLOWING ISSUES IN SHORT; FOLLOW THE GUIDANCE OF FAR 52.219-9 IN ITS ENTIRETY. FOR EXAMPLE, PARAGRAPH 11 BELOW ASKS FOR A DISCUSSION OF RECORDS; THE PLAN SHOULD ADDRESS ALL RECORDS AS DESCRIBED IN FAR 52.219-9(d)(11)(i) THROUGH (vi).

IN ACCORDANCE WITH FAR 19.704 IF THE CONTRACT CONTAINS OPTIONS, THE CUMULATIVE VALUE OF THE BASIC CONTRACT AND ALL OPTIONS IS CONSIDERED IN DETERMINING WHETHER A SUBCONTRACTING PLAN IS NECESSARY. ONCE IT HAS BEEN DECIDED IF A PLAN IS NECESSARY, THE SUBCONTRACTING PLAN SHALL CONTAIN SEPARATE PARTS, ONE FOR THE BASIC CONTRACT AND ONE FOR EACH OPTION. *IN OTHER WORDS, IT IS NECESSARY TO ADDRESS PLANNED SUBCONTRACTING DOLLARS AND PERCENTAGES OF TOTAL TO BE AWARDED TO SMALL, VETERAN-OWNED SMALL, HUBZONE SMALL, SMALL DISADVANTAGED, WOMEN-OWNED SMALL, HBCU/MIs, AND QUALIFIED NONPROFIT AGENCIES FOR THE BLIND AND OTHER SEVERELY DISABLED SEPARATELY FOR THE BASIC CONTRACT PERIOD AND EACH OPTION YEAR. THEREFORE, PARAGRAPHS 1 AND 2 BELOW MUST BE PREPARED SEPARATELY FOR THE BASE YEAR AND EACH OPTION YEAR. ALL OTHER PARTS OF THE SUBCONTRACTING PLAN ONLY NEED TO BE ADDRESSED ONCE.*

IF THE SUBCONTRACTING PLAN'S PROPOSED SUBCONTRACTING GOALS DO NOT MEET THE CORPS OF ENGINEERS' MINIMUM SUBCONTRACTING FLOORS, THE SUBCONTRACTING PLAN MUST BE SUBMITTED WITH A FULL EXPLANATION OF THE REASONS FOR THE LESSER GOALS ESTABLISHED BY THE PLAN. A SMALL DISADVANTAGED BUSINESS GOAL OF LESS THAN FIVE PERCENT MUST BE APPROVED TWO LEVELS ABOVE THE CONTRACTING OFFICER (DFARS 219.705-4).

PROJECT TITLE: _____

RFP/IFB NO.: _____ CONTRACT NO.: _____

CONTRACTOR NAME: _____

DIVISION: _____

INDIVIDUAL COMPLETING THIS PLAN: _____

TELEPHONE NO.: _____

1. Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business, veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance and may include a proportionate share of products and services that are normally allocated as indirect costs.

Percentage Goals:		Corps of Engineers Minimum Subcontracting Floors
Small Business	_____%	61.4%
Small Disadvantaged Business	_____%	9.1%
Women-Owned Small Business	_____%	5.0%

*Service-disabled veteran-owned small business concerns meet the definition of veteran-owned small business concerns, and offerors may include them within the subcontracting plan goal for veteran-owned small business concerns. A separate goal for service-disable veteran-owned small business concerns is not required.

2. Statement of: (i) total dollars planned to be subcontracted, (ii) total dollars planned to be subcontracted to small business; (iii) total dollars planned to be subcontracted to veteran-owned small business; (iv) total dollars planned to be subcontracted to HUBZone small business; (v) total dollars planned to be subcontracted to small disadvantaged business; and (vi) total dollars planned to be subcontracted to women-owned small business.

Total Cost of Prime Contract:	\$_____	
Total Dollars to be Subcontracted	\$_____	_____ %*
To Small Business	\$_____	_____ %**
To Veteran-owned Small Business	\$_____	_____ %**
To HUBZone Small Business	\$_____	_____ %**
To Small Disadvantaged Business	\$_____	_____ %**
To Women-Owned Small Business	\$_____	_____ %**

NOTES: * Calculate percentage of Total Dollars to be Subcontracted to Total Cost of Prime Contract

** Calculate subcontracted dollars to each group to Total Dollars to be Subcontracted, NOT TO Total Cost of Prime Contract.

PLANNED SUBCONTRACTING INCLUDES ALL PLANNED EXPENDITURES. TOTAL ESTIMATED COST TO SUBCONTRACTORS AND GOALS MUST BE ESTABLISHED EVEN IF

THE CONTRACT IS OF THE INDEFINITE-DELIVERY TYPE.

SUBCONTRACTS AWARDED TO VETERAN-OWNED SMALL BUSINESSES, HUBZONE SMALL BUSINESSES, SMALL DISADVANTAGED BUSINESSES, WOMEN-OWNED SMALL BUSINESSES, HBCU/MIs, AND QUALIFIED NONPROFIT AGENCIES FOR THE BLIND AND OTHER SEVERELY DISABLED COUNT TOWARD THE OVERALL SMALL BUSINESS GOAL. HBCU/MIs ARE COUNTED AS A SUBSET OF THE SMALL DISADVANTAGED GOAL. THE CORPS OF ENGINEERS HAS NOT BEEN ASSIGNED A SET GOAL FOR VETERAN-OWNED SMALL BUSINESS, HUBZONE SMALL BUSINESS, HBCU/MIs OR QUALIFIED NONPROFIT AGENCIES FOR THE BLIND AND OTHER SEVERELY DISABLED.

IN ACCORDANCE WITH DFARS 219.703, QUALIFIED NONPROFIT AGENCIES FOR THE BLIND AND OTHER SEVERELY DISABLED THAT HAVE BEEN APPROVED BY THE COMMITTEE FOR PURCHASE FROM PEOPLE WHO ARE BLIND OR SEVERELY DISABLED UNDER THE JAVITS-WAGNER-O'DAY (41 U.S.C. 46-48) ARE ELIGIBLE TO PARTICIPATE IN THE PROGRAM AS A RESULT OF 10 U.S.C. 2410d AND SECTION 9077 OF PUB. L. 102-396 AND SIMILAR SECTIONS IN SUBSEQUENT DEFENSE APPROPRIATIONS ACTS. UNDER THIS AUTHORITY SUBCONTRACTS AWARDED TO SUCH ENTITIES MAY BE COUNTED TOWARD THE PRIME CONTRACTOR'S SMALL BUSINESS SUBCONTRACTING GOAL.

3. A description of the principal types of supplies and services to be subcontracted and an identification of the types planned for subcontracting to (i) small business concerns, (ii) veteran-owned small business concerns, (iii) HUBZone small business concerns, (iv) small disadvantaged business concerns, (v) women-owned small business concerns, (vi) HBCUs and MIs, (vii) qualified nonprofit agencies for the blind and other severely disabled.

4. A statement of the method used in developing the proposed subcontracting goals for small business concerns, veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, women-owned small business concerns, HBCUs and MIs, and qualified nonprofit agencies for the blind and other severely disabled.

5. A description of the method used to identify potential sources for solicitation purposes to assure small, veteran-owned small, HUBZone small, small disadvantaged, women-owned small, HBCU and MI, and qualified nonprofit agencies for the blind and other severely disabled participation (e.g., existing company source lists, the Procurement Marketing and Access Network (PRO-Net) of the Small Business Administration (SBA), the list of certified small disadvantaged business concerns of the SBA, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, veteran-owned small, HUBZone small, small disadvantaged, and women-owned small business trade associations).

6. A statement as to whether or not the offeror included indirect costs in establishing the subcontracting goals, and if so, a description of the method used to determine the proportionate share of indirect costs to be incurred with: (i) small business concerns, (ii) veteran-owned small business concerns, (iii) HUBZone small business concerns, (iv) small disadvantaged business concerns, (v) women-owned small business concerns, (vi) HBCUs and MIs), and (vii) qualified nonprofit agencies for the blind and other severely disabled.

7. The name of the individual employed by the offeror who will administer the offeror's subcontracting program and a description of the duties of the individual.

Name: _____

Title and Telephone Number: _____

Address: _____

City, State and Zip Code: _____

Duties (Attachment may be used):

8. Describe the efforts the offeror will make to assure that small business concerns, veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, women-owned small business concerns, HBCUs and MIs, and qualified nonprofit agencies for the blind and other severely disabled will have an equitable opportunity to compete for subcontractors under this contract.

9. I do herewith assure that this concern will include the clause at FAR 52.219-8 entitled "Utilization of Small Business Concerns" in all subcontracts which offer further subcontracting opportunities and will require all subcontractors (except small business concerns) who receive subcontracts in excess of \$500,000 (\$1,000,000 for construction of any public facility) to adopt a plan similar to the plan agreed to by this concern and in consonance with the FAR clause 52.219-9.

10. I also assure that this concern will (i) cooperate in any studies or surveys as may be required, (ii) submit periodic reports in order to allow the Government to determine the extent of compliance by the offeror with the subcontracting plan, and (iii) submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and SF 295, Summary Subcontract Report, in accordance with the instructions of the forms, and (iv) ensure that the subcontractors under this contract agree to submit the required SF 294s and 295s. I assure that this concern will submit an SF 295 on Corps of Engineers projects only. The SF 295 shall be completed and distributed in accordance with the Corps of Engineers supplemental instructions. I will not report Corps of Engineers projects through any other agency unless authorized by the Contracting Officer.

11. Provide a description of the types of records the offeror will maintain to demonstrate procedures which have been adopted to comply with the requirements and goals set forth in the plan, including the establishment of source lists; and a description of its efforts to locate small business, veteran-owned small business, HUBZone small business, small disadvantaged business, women-owned small business, HBCUs and Mis, and qualified nonprofit agencies for the blind and other severely disabled and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

a. Source lists (e.g., PASS), guides, and other data that identify small business, veteran-owned small business, HUBZone small business, small

disadvantaged business, women-owned small business concerns, HBCUs and MIs, and qualified nonprofit agencies for the blind and other severely disabled.

b. Organizations contacted in an attempt to locate sources that are small business, veteran-owned small business, HUBZone small business, small disadvantaged business, women-owned small business, HBCUs and MIs, and qualified nonprofit agencies for the blind and other severely disabled.

c. Records on each subcontract solicitation resulting in an award of more than \$100,000, indicating (1) whether small business concerns were solicited and if not, why not; (2) whether veteran-owned small business concerns were solicited and if not, why not; (3) whether HUBZone small business concerns were solicited and if not, why not; (4) whether small disadvantaged business concerns were solicited and if not, why not; (5) whether women-owned small business concerns were solicited and if not, why not; (6) whether HBCUs and MIs were solicited and if not, why not; (7) whether qualified nonprofit agencies for the blind and other severely disabled were solicited and if not, why not; and (8) if applicable, the reason award was not made to a small business concern.

d. Records of any outreach efforts to contact (A) trade associations, (B) business development organizations, and (C) conferences and trade fairs to locate small, veteran-owned small, HUBZone small, small disadvantaged, women-owned small business, HBCUs and MIs, and qualified nonprofit agencies for the blind and other severely disabled sources.

e. Records of internal guidance and encouragement provided to buyers through (A) workshops, seminars, training, etc., and (B) monitoring performance to evaluate compliance with the programs's requirements.

f. On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having company or division-wide annual plans need not comply with this requirement.

12. Discuss the extent to which the offeror has historically been successful in complying with the requirements of the clauses at FAR 52.219-8, Utilization of Small Business Concerns, and 52.219-9, Small Business Subcontracting Plan, in establishing realistic yet challenging goals and show evidence of ability to achieve the goals. Information addressing past performance on DoD contracts evidencing achievement of established subcontracting goals will be in the form of Standard Forms 294 and 295 (attach these to this plan). Offerors who have had no prior Department of Defense contracts from which to assess past performance will not be penalized. Those who have had prior DoD contracts must provide the SF 294s and 295s on past DoD contracts.

(Signature)

(Title of Corporate Officer)

ATTACHMENT NO. 5

DRAWING LIST

ATTACHMENT NO. 5

DRAWING LIST

G1.0	1	TITLE SHEET
G2.0	2	SHEET INDEX
G3.0	3	GENERAL SYMBOLS AND ABBREVIATIONS
G4.0	4	PROCESS FLOW DIAGRAM
C1.0	5	SITE AND UTILITY PLAN
C2.0	6	GRADING AND PAVING PLAN
C2.1	7	LOCATION OF EXPLORATIONS LEGEND AND NOTES
C2.2	8	LOGS OF EXPLORATIONS
C3.0	9	SITE CROSS SECTIONS AND DETAILS
C4.0	10	CHAIN-LINK FENCE AND GATE DETAILS
C5.0	11	MISCELLANEOUS CIVIL DETAILS
C5.1	12	MISCELLANEOUS CIVIL DETAILS
C6.0	13	EXISTING WATER TREATMENT PLANT DEMOLITION PLAN
P1.0	14	HOUSING AREA PIPING - SHEET INDEX
P2.0	15	PIPING PLAN AND PROFILE STATION 10+00 TO STATION 9+00
P3.0	16	PIPING PLAN AND PROFILE STATION 19+00 TO HOUSING TANKS
P4.0	17	MISCELLANEOUS PIPING DETAILS
5.0	18	MISCELLANEOUS PIPING DETAILS
P6.0	19	HOUSING AREA LOCATION AND LOGS OF EXPLORATIONS
L1.0	20	LANDSCAPING PLAN
L2.0	21	IRRIGATION PLAN
L3.0	22	IRRIGATION AND LANDSCAPE DETAILS
A1.0	23	OPERATIONS BUILDING FLOOR PLAN
A2.0	24	OPERATIONS BUILDING ELEVATIONS AND SECTIONS
A3.0	25	OPERATIONS BUILDING SECTIONS AND WALL DETAILS
A4.0	26	"OPERATIONS BUILDING WINDOWS, DOORS AND LOUVER DETAILS"
A5.0	27	OPERATIONS BUILDING MISCELLANEOUS DETAILS
S1.0	28	GENERAL STRUCTURAL NOTES AND TYPICAL STRUCTURAL DETAILS
SS2.0	29	OPERATIONS BUILDING FOUNDATION PLAN AND SECTIONS
S3.0	30	OPERATIONS BUILDING ROOF FRAMING PLAN AND SECTIONS
S4.0	31	OPERATIONS BUILDING SECTIONS AND DETAILS
S5.0	32	OPERATIONS BUILDING SECTIONS AND DETAILS
S6.0	33	AERATED WATER SUMP PLANS
S7.0	34	AERATED WATER SUMP SECTIONS
S8.0	35	FILTER VESSEL FOUNDATION PLAN AND SECTIONS
S9.0	36	BACKWASH WATER TANK PLAN AND SECTIONS
M1.0	37	WATER TREATMENT PLANT PIPING PLAN 1
M2.0	38	WATER TREATMENT PLANT PIPING PLAN 2
M3.0	39	WATER TREATMENT PLANT SECTIONS AND DETAILS
M4.0	40	WATER TREATMENT PLANT SECTIONS
M5.0	41	OPERATIONS BUILDING MECHANICAL PLAN
M6.0	42	CHEMICAL TANKS PLAN AND SECTIONS
M7.0	43	OPERATIONS BUILDING MECHANICAL SECTIONS
M8.0	44	OPERATIONS BUILDING HVAC PLAN
M8.1	45	OPERATIONS BUILDING HVAC SECTION AND DETAILS
M8.2	46	OPERATIONS BUILDING PLUMBING PLAN
M8.3	47	"OPERATIONS BUILDING DRAIN, POTABLE & NON-POTABLE WATER ISO"
M9.0	48	"BACKWASH WATER TANK PLAN, SECTIONS AND DETAILS"
M10.0	49	BACKWASH WATER TANK DETAILS

M11.0	50	PIPE SUPPORTS AND MISCELLANEOUS DETAILS
M12.0	51	MISCELLANEOUS MECHANICAL DETAILS
E1.0	52	ELECTRICAL SYMBOLS AND ABBREVIATIONS
E2.0	53	SINGLE LINE DIAGRAM
E2.1	54	SCHEDULES
E3.0	55	SWITCHBOARD AND MCC
E4.0	56	ELECTRICAL AREA PLAN AND NOTES
E4.1	57	ELECTRICAL SITE PLAN AND NOTES
E5.0	58	CONTROL WIRING DIAGRAM 1
E6.0	59	CONTROL WIRING DIAGRAM 2
E7.0	60	OPERATIONS BUILDING PLAN
E7.1	61	OPERATIONS BUILDING LIGHTING AND SMALL POWER PLAN
E7.2	62	OPERATIONS BUILDING SPECIAL SYSTEMS PLAN
E8.0	63	CONDUIT SCHEDULE
E9.0	64	ELECTRICAL DETAILS 1
E10.0	65	ELECTRICAL DETAILS 2
E11.0	66	ELECTRICAL DETAILS 3
E12.0	67	ELECTRICAL DETAILS 4
E13.0	68	ELECTRICAL DETAILS 5
I1.0	69	INSTRUMENTATION AND CONTROLS SYMBOLS AND ABBREVIATIONS
I2.0	70	PROCESS AND INSTRUMENTATION DIAGRAM 1
I3.0	71	PROCESS AND INSTRUMENTATION DIAGRAM 2
I4.0	72	PROCESS AND INSTRUMENTATION DIAGRAM 3
I5.0	73	PROCESS AND INSTRUMENTATION DIAGRAM 4
I6.0	74	INSTRUMENTATION DETAILS
I7.0	75	PLC DIAGRAM AND CONTROL PANEL ELEVATION
I8.0	76	INTERCONNECTION WIRING DIAGRAM
I9.0	77	SCADA SYSTEM BLOCK DIAGRAM

ATTACHMENT NO. 6

CONTRACTOR PREPARED AS-BUILTS

November 15, 1999

COMPLETION OF AS-BUILT DRAWINGS **BY CONSTRUCTION CONTRACTOR**

INTRODUCTION:

As-Built drawings are prepared to show changes made to the project during construction, and are the official records of the project at the time of construction completion. All additions, deletions and other changes made during construction are indicated by modifying the original contract drawings. Accurate as-built drawings are very important for operation and maintenance, and when modifications to a facility are made in the future, particularly for plumbing and electrical systems which are hidden from view.

Instructions for preparing high-quality As-Built drawings are contained in the following paragraphs.

MARKED-UP PRINTS: (Working As-Built)

Whenever changes, additions or deletions from the original design are made during construction, they **will immediately** be noted on each of the as-built print set, as appropriate. No other marks, doodles, notes, or annotations shall be put on these sets of as-built prints. All changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction will be accurately and neatly recorded as they occur by means of details and notes. All changes and/or required additions to the paper prints will be clearly identified in color contrasting to blue or black, preferably **red**. The as-built print sets will be annotated in as much detail as necessary to clarify exactly what construction changes were performed.

Areas of Concern: The following are some of the general items that need some special checking to ensure that the marked-up prints are complete and accurate:

- (1) Location, size and type of existing and new utility lines, especially underground lines within the construction area. Measurements will be shown for all change of direction points and all surface or underground components such as valves, manholes, drop inlets, clean outs, meters, etc. The descriptions of exterior utilities shall include the actual quantity, size, and material of the utility lines.
- (2) Layout and schematic drawings of electrical circuits and piping.
- (3) Correct dimensions and details transferred from shop drawings.

- (4) Verification of alignment, cross section, and layout of the earthwork.
- (5) Actual location of anchors, construction and control joints, etc., in concrete.
- (6) Changes in location of equipment and architectural features.
- (7) Cross out such words and phrases as "optimal requirement," "or equal," etc., and list specifically the items of material provided.
- (8) Unusual or uncharted obstructions that are encountered in the contract work area during construction.
- (9) Location, extent, thickness, and size of stone protection particularly where it will be normally submerged by water.

Mark-up Guidelines: The following information is provided to the Contractor as suggestion to improve the quality of the marked-up prints and thereby facilitate preparation of as-built drawings after construction. The most important guideline is that the marked-up changes on the prints shall be complete and understandable. The draftsman who later will make the corrections on the original tracings likely will not have worked on the original design and probably will not have been on-site during the construction of the project. Visits to the site by the draftsman, or visits to the draftsman by the construction superintendent, can be minimized by providing complete and understandable marked-up prints.

- (1) Use written explanations on As-Built drawings more frequently to describe changes - do not rely totally on graphic means to convey the revision.
- (2) Legibility of lettering and digit values shall be precise and clear when marking prints, and clarify ambiguities concerning the nature and application of change involved.
- (3) Wherever a revision is made, make changes to affect related section views, details, legend, profiles, plans and elevation views, schedules, notes and call-out designations, and mark accordingly to avoid conflicting data on all other sheets.
- (4) When changes are made, cross out all features, data and captions that relate to that revision.
- (5) When changes are required on small scale drawings and in restricted areas, suggest large scale inserts be drawn or sketched, with leaders to the location where applicable.

(6) Be sure descriptive markings in red conform with legend symbols shown, or provide a legend if other colors are used.

(7) Be sure to add and denote in legend, any additional equipment or material facilities, service lines, etc., incorporated under As-Built Revision if not already shown in legend.

(8) When attached prints (or sketches) are provided with marked-up print, indicate whether a) entire drawing shall be added to contract drawings or b) whether the contract drawings shall be changed to agree, or c) for reference only to further details not required for initial design.

(9) Make the comments on the drawing complete without reference to letters, memo's, or materials that are not also a part of the As-Built.

(10) Annotating the drawing, "Per Change Order #42," means nothing when the actual change order states, "added an additional 12 duplex" outlets or similar statements. The same is true when the drawing is marked, "changed per COE instructions." This office and ultimately the using organizations must know what was changed, how it was changed, where the items(s) were relocated to and how the affected connections were altered. Change Orders usually do not provide information as to how the facility was changed, only what was changed.

(11) The markups shall be accomplished on blue or black line copies of the **most current originals**. Frequently the packages received consist of blue or black lines which do not include one or more revisions made on the originals through the amendment process prior to contract award. This raises the question, which drawing was used for construction? This is especially true if major revision to the facility have been made on the originals.

(12) Shop drawings are to be incorporated into the As-Built drawings. They will be provided in electronic CAD file format (or 3 mil double matte polyester or photo mylar for non-electronic contracts). Hand drawn or plotted paper shop drawings will not be accepted as submittals.

The quality of shop drawings which normally accompany "As-Built" packages are **not** usable as original drawings for several reasons.

a) The "shop drawings" are not reproducible in blue line form.

b) The drawings are not of an adequate scale or are drawn to no scale and are not transferable to the CORPS drawings due to

lack of information.

c) The limited numbers of reproducible shop drawings that have been received have not been on the Corps of Engineers standard sheets sizes making it difficult to convert these drawings to standard COE drawings.

Any drawing provided by non-COE sources will be drawn in CAD. Sheets shall be drawn at the same scale as similar drawings in the set (example: Fire alarm systems shall be drawn to the same scale as the plumbing or electrical drawings). The drawing shall meet the same standards required for the rest of the drawings set. Details and sketches shall be tied to existing drawings by sheet number, detail number, etc.

AS-BUILT DRAWINGS: (Final As-Builts)

The contractor will transfer the changes from the marked-up prints to the original electronic CAD files (or original mylar drawings).

DRAFTING STANDARDS:

The Corps requires that standard professional engineering drafting practices be utilized in correcting the original contract mylar or electronic CAD drawings to show as-built conditions. In general, the letter styles, line thickness, and scale will be the same as the original drawings. Corrections will be made in black ink, unless the originals are prepared in pencil, in which case the corrections also will be in pencil. When shop drawings or other sheets are added, they will be drawn in electronic CAD or on 3 mil double matte mylar or reproduced on photo mylar and will be the same size and layout as the original drawings. The following specific requirements apply to the preparation of as-built drawings:

The Title Sheet (first sheet): The first sheet will be labeled with the word AS-BUILT (stamp to be purchased by the contractor). The words CONTRACT NUMBER and the actual contract number will be entered using a size 140 Leroy templet and a No. 1 pen (or equal CAD font style and size) as shown on attachment 1. The contract number contains the Fiscal Year, the letter C (for construction), and the sequence number (example: 96-C-0000). No other work need be done on this sheet unless sheets are being added or deleted from the List of Drawings or other actual changes are made on this sheet. (See attachment 1.)

The second and subsequent sheets: All the sheets following the title sheet will be labeled with the AS-BUILT stamp. (See Attachment 2.)

Signature representation (CAD files only): All signatures that appear on the approved original design drawings need to be represented on all the electronic as-built files. The format

for these are /s/Name (i.e. /s/Raymond Dennis). The only name that does not require the /s/ is the District Commander's name that appears only on the cover sheet (the title sheet). (See Attachments 1 & 2.)

Revisions Block entries: Those sheets which have no changes will only be labeled AS-BUILT as described above. Those sheets which have changes shown on them will have REVISED AS-BUILT entered in the first available space. This will be revision one and a number 1 will be entered in the triangle at the beginning of that line. In the event the sheet has already been revised and a number and revision appear in the revision lines the next sequential number will be used. Normally the first entry is made in the first line. The completed originals drawings (or CAD files) will be reviewed for accuracy and initialed by the Contractor. (See Attachments 2 & 3.)

Marking Revisions: All changes will be indicated by placing an equilateral triangle (3/8" per side) near the area revised. Where several items in a table or detail are changed (or completely redrawn), one triangle may be placed near the table or detail title. This same method may be used for general revisions to floor plans and system plans (plumbing, electrical, a/c, heating); when a major portion of the drawing is changed, the triangle may be placed near the diagram, detail, section or plans title. When only a few items are revised, added or deleted a triangle will be placed near each item. The triangles will contain the same number as the As-Built revision on that sheet. (See Attachment 4.)

Revision Procedure: Deletion - when the marked-up print indicates an item was not installed, the item will be crossed out on the drawing along with any associated devices, connecting lines, ducts, pipes etc., including notes and dimensions. When a detail is indicated as not being used, the detail may be boxed and NOT USED lettered across the detail. A box will be drawn on the (reverse side for manual drawings) sheet with an X as shown in Attachment 5. The words NOT USED will be in heavy block lettering a minimum of 5/8" high. A triangle and revision number will be placed inside the box where notes are indicated as not being used. Notes - a line may be drawn thru the note or line item in a table in lieu of erasing the line item or note. The line will be drawn on the reverse side for manual drawings. A triangle and number will be placed near the deleted item. Additions - When the marked-up print indicates items have been added, the new or additional item or items will be drawn on the original and associated connections made if the print indicates such connections. A triangle and number will be placed near the new item. All lettering **will conform** to the existing lettering on each sheet.

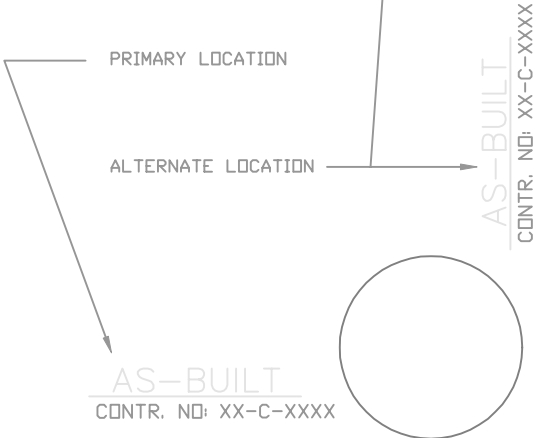
Relocations: When the marked-up print indicates an item has been moved and the new location is shown or indicated, the item will be drawn in the new location and erased from the old location. All connections will be transferred if applicable, such as wiring, piping, ducts. Revision triangles with appropriate number will be shown at the new and old location.

Drawing continuity: The applicable drawings shall be marked-up when a change was made, although this will not always be the case. Final responsibility for drawing continuity is

with the person doing the As-Built. When one floor plan indicates a wall, room, doors etc., has been changed, the same change shall be made on all other applicable drawings. When the change is applicable to only one discipline such as electrical and does not directly affect other discipline sheets, a note may be added to other discipline sheets such as "See sheet _____ for As-Built Conditions."

Shop drawings: When shop drawings are added to the original contract drawing set they need to be appropriately labeled with the Sacramento District file number, and discipline and sequence sheet number. The Index of Drawings will also need to be revised to show the additional sheet (s) with the appropriate sheet title. In the case where the shop drawing are smaller than the Corps standard sheet size (i.e. 8.5"x11" or 11"x17" etc.) the sheets will be cut into a standard Corps sheet size border sheet and appropriately labeled. (For additional information refer to Mark-up Guidelines, Shop drawings above.)

CAD Standards: All asbuilt "triangled" changes (refer to MARKED REVISIONS paragraph above) shall be on a separate single layer named ASBUILT, using a single color with an associated medium pen width. Electronic CAD file and shop drawings will conform to the Sacramento District CAD Standards and the Tri-Services CAD Standards. File Naming Convention will be maintained on all existing CAD files and followed for any new files added. (Refer to <http://www.spk.usace.army.mil/cespk-ed/cadd/standards.html>)



PRIMARY LOCATION

ALTERNATE LOCATION

AS-BUILT
CONTR. NO: XX-C-XXXX

AS-BUILT
CONTR. NO: XX-C-XXXX

Approved Functional Adequacy Title /S/PRINTED NAME MM/DD/YY Date	Designed by DESIGNER Spec No. SPEC File Name FILE_NAME	Drawn by DRAFTER Design File No FILE Plot Date PLOT_DATE	Approved /S/PRINTED NAME MM/DD/YY Chief, Engineering Division Prepared Under the Direction of COMMANDERS NAME Col. Corps of Engineers District Engineer
---	---	---	--

BASE_NAME	STATE
PROJECT_TITLE_1	PROJECT_TITLE_2
SHEET_NAME	SHEET_NAME_2
SHEET_NAME_3	

Sheet reference number: SHT#
SEQ#

AS-BUILT
CONTR. NO: XX-C-XXXX



DATE1	DATE2	DATE3	DATE4	DATE5	DATE6	DATE7	DATE8	Date	Approved
APPROVIAL 1	APPROVIAL 2	APPROVIAL 3	APPROVIAL 4	APPROVIAL 5	APPROVIAL 6	APPROVIAL 7	APPROVIAL 8		

Symbol	Description	Date Approved
Δ	DISCRIPTION1	DATE APPROVAL1
Δ	DISCRIPTION2	DATE APPROVAL2
Δ	DISCRIPTION3	DATE APPROVAL3
Δ	DISCRIPTION4	DATE APPROVAL4
Δ	DISCRIPTION5	DATE APPROVAL5
Δ	DISCRIPTION6	DATE APPROVAL6
Δ	DISCRIPTION7	DATE APPROVAL7
Δ	DISCRIPTION8	DATE APPROVAL8

Designed by DESIGNER	Date: DATE	Rev. REV.#
Drawn by DRAWN BY	Design file no FILE NO.	
Checked by CHECKED BY	SPEC. No SPEC. NO.	
Reviewed by REVIEWED BY	File name FILE NAME	
Submitted by SUBMITTED BY	Plot date PLOT DATE	
Signature SIGNATURE	Plot scale PLOT SCALE	

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

A/E NAME AND ADDRESS

STATE

PROJECT_TITLE_1	PROJECT_TITLE_2	SHEET_NAME	SHEET_NAME_2	SHEET_NAME_3
-----------------	-----------------	------------	--------------	--------------

BASE_NAME

Sheet
reference
number:

SHT#
SEQ#

Attachment 2

- PRIMARY LOCATION

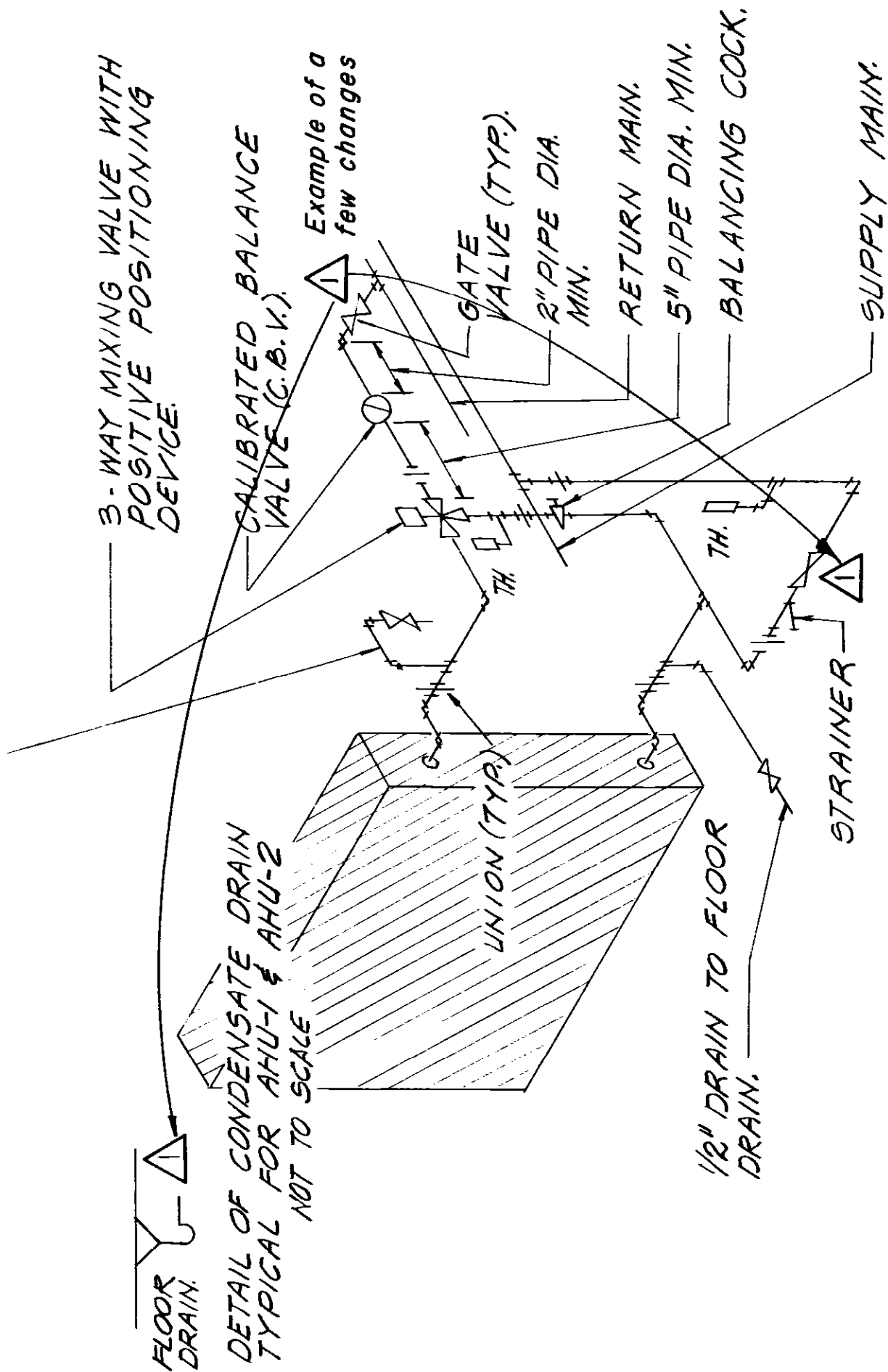
ALTERNATE LOCATION



US Army Corps
of Engineers
Sacramento District

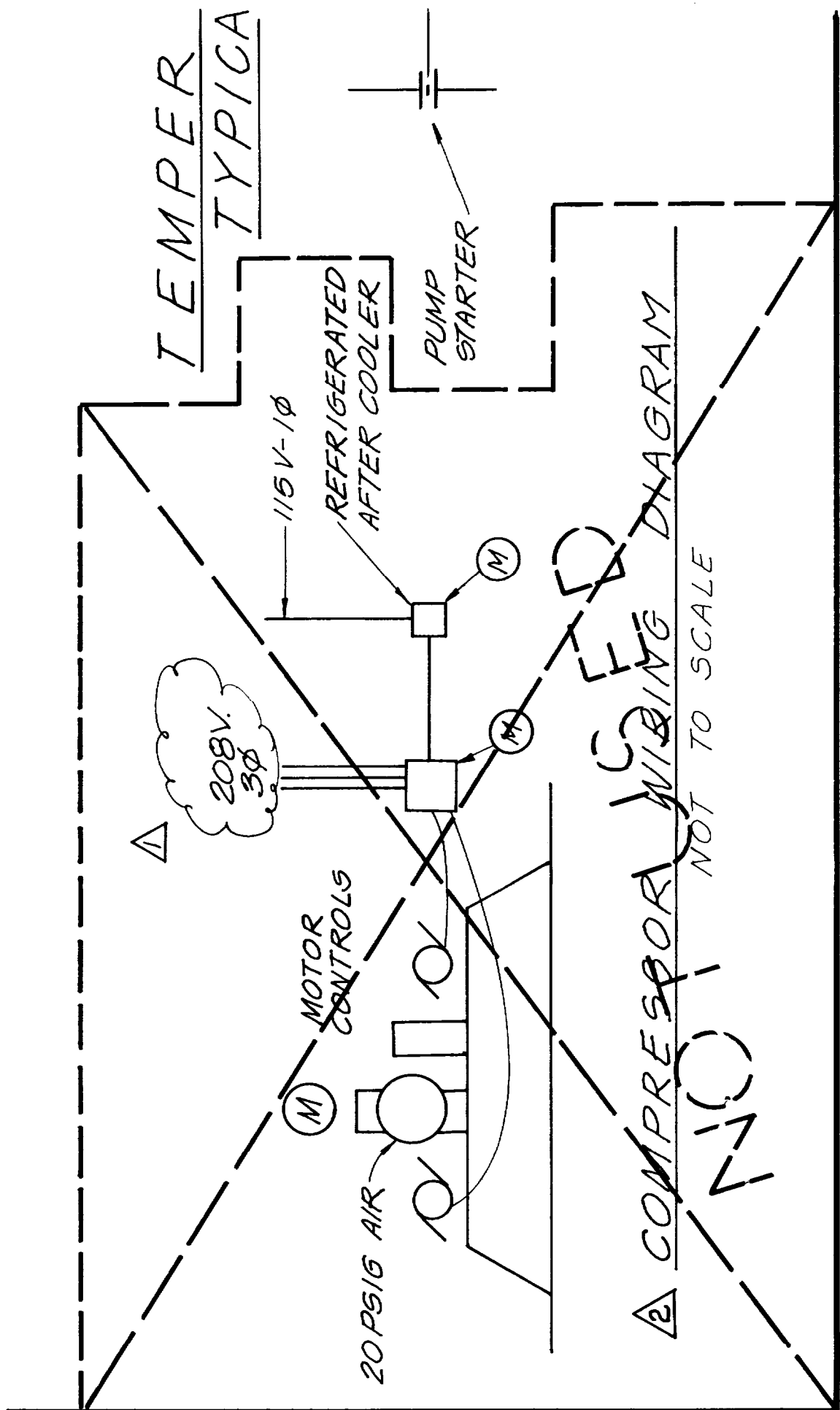
Initials of person checking revisions
Initials of person doing revisions

Symbol	REVISOR	DATE	DESCRIPTION	DATE APPROVED	APPROVER
△					
△					
△					
△					
△					
△					
△					
△					



△ TYPICAL CONNECTIONS TO CHILLED WATER COILS.

NOT TO SCALE
 Example of general revisions



When an entire Detail, Section or View has been deleted it is indicated. Solid heavy lines are drawn on the back side of the sheet. "VOID" or "NOT USED" is lettered on the front. Dashed lines shown here for clarity.

TECHNICAL SPECIFICATIONS

PROJECT TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

01320 PROJECT SCHEDULE
01330 SUBMITTAL PROCEDURES
01355 ENVIRONMENT PROTECTION
01451 CONTRACTOR QUALITY CONTROL
01500 TEMPORARY CONSTRUCTION FACILITIES
01505 GENERAL REQUIREMENTS
01510 WORK SEQUENCE AND GOVERNMENT FURNISHED ITEMS
01600 MATERIAL AND EQUIPMENT (BEALE AFB)
01700 CONTRACT CLOSEOUT (BEALE AFB)

DIVISION 02 - SITE WORK

02220 DEMOLITION
02230 CLEARING AND GRUBBING
02300 EARTHWORK
02510 WATER SYSTEM PIPING AND ACCESSORIES
02531 SANITARY SEWERS
02630 STORM-DRAINAGE SYSTEM
02705 PAVING AND RESURFACING
02821 FENCING
02930 EXTERIOR PLANTING
02950 IRRIGATION SYSTEM

DIVISION 03 - CONCRETE

03100 STRUCTURAL CONCRETE FORMWORK
03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS
03200 CONCRETE REINFORCEMENT
03300 CAST-IN-PLACE STRUCTURAL CONCRETE

DIVISION 04 - MASONRY

04200 MASONRY

DIVISION 05 - METALS

05120 STRUCTURAL STEEL
05500 MISCELLANEOUS METAL

DIVISION 06 - WOODS & PLASTICS

06610 FIBERGLASS REINFORCED PANELS

DIVISION 07 - THERMAL & MOISTURE PROTECTION

07190 WATER REPELLENT SEALER
07200 INSULATION
07220 ROOF INSULATION
07412 NON-STRUCTURAL METAL ROOFING
07600 SHEET METALWORK, GENERAL
07900 JOINT SEALING

DIVISION 08 - DOORS & WINDOWS

08110 STEEL DOORS AND FRAMES

08330 OVERHEAD ROLLING DOORS
08520 ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS
08700 BUILDERS' HARDWARE

DIVISION 09 - FINISHES

09250 GYPSUM WALLBOARD
09650 RESILIENT FLOORING
09900 PAINTING, GENERAL
09915 COLOR SCHEDULE
09960 PROTECTIVE COATINGS

DIVISION 10 - SPECIALTIES

10050 BUILDING SPECIALTIES
10200 LOUVERS
10400 IDENTIFYING DEVICES
10800 TOILET ACCESSORIES

DIVISION 11 - EQUIPMENT

11001 GENERAL EQUIPMENT AND MECHANICAL REQUIREMENTS
11003 DISINFECTION
11215 VERTICAL TURBINE PUMPS
11350 AERATOR
11353 BRINE MAKE-UP SYSTEM
11354 CHLORINE FEED SYSTEM
11355 FLUORIDE FEED SYSTEM
11357 PRESSURE FILTERS

DIVISION 12 - FURNISHINGS

12320 CABINETS AND COUNTERTOPS

DIVISION 13 - SPECIAL CONSTRUCTION

13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT
13202 ABOVEGROUND FUEL TANK
13211 WELDED STEEL TANK
13405 PROCESS CONTROLS
13410 CONTROL STRATEGIES
13416 CHEMICAL STORAGE TANK
13721 SMALL INTRUSION DETECTION SYSTEM
13820 MULTI-BUILDING EXPANSION OF ENERGY MONITORING AND CONTROL SYSTEMS
13850 FIRE DETECTION AND ALARM SYSTEM, DIRECT CURRENT LOOP

DIVISION 15 - MECHANICAL

15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT
15200 PIPELINES, LIQUID PROCESS PIPING
15400 PLUMBING
15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

DIVISION 16 - ELECTRICAL

16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT
16120 INSULATED WIRE AND CABLE
16261 VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS
16264 DIESEL-GENERATOR SET, STATIONARY 15-300 KW, STANDBY APPLICATIONS

16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL
16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND
16403 MOTOR CONTROL CENTERS, SWITCHBOARDS AND PANELBOARDS
16410 AUTOMATIC TRANSFER SWITCH
16415 ELECTRICAL WORK, INTERIOR
16528 EXTERIOR LIGHTING INCLUDING SECURITY
16710 PREMISES DISTRIBUTION SYSTEM
16711 TELEPHONE SYSTEM, OUTSIDE PLANT

-- End of Project Table of Contents -

INDEX

SECITON 01000

GENERAL REQUIREMENTS

1. SCOPE
2. WORKING HOURS
3. MAINTAINING BUSINESS AS USUAL
4. SPECIAL CONSIDERATIONS
5. DISPOSAL OF REMOVED MATERIALS AND REFUSE
6. USE OF UTILITIES
7. UTILITY SHUTDOWNS
8. SAFETY
9. STORAGE AREAS
10. EMERGENCY ACCESS
11. AS-BUILT DRAWINGS
12. DUST CONTROL
13. DIGGING PERMIT
14. EXCLUSION PERIOD

15. SECTION 01000

GENERAL REQUIREMENTS

1. SCOPE. The contractor shall furnish all labor, supervision, materials, tools, equipment, and incidentals and do all the work involved as necessary for a complete working Water Treatment Plant at Beale AFB, CA, as specified herein. All work shall be accomplished complete in place in accordance with JAW) the contract specifications, drawings, and as directed by the C.O.

1.2 The primary items of work are listed in the Bid Schedule.

2. WORKING HOURS. Working hours for the contractor will normally be between the hours of 7:00 a.m. and 5:00 p.m. during the week (Monday - Friday). If the contractor desires to work during periods other than these, he/she must obtain approval from the C.O. three days in advance to allow assignment of additional inspection forces if they are reasonably available.

3. MAINTAINING BUSINESS AS USUAL.

3.1 The contractor must coordinate all phases of the project with the inspector and the C.O. at the beginning of each week (Monday morning), and indicate on a copy of the plans which locations and types of work he/she will be engaged with that week. The inspector in turn will coordinate project operations with other agencies such as the fire dept, security police, airfield management, and so forth. The contractor shall notify the inspector prior to changing locations if different from that given each Monday.

3.2 Airfield. The contractor shall not enter any airfield areas or drive on any airfield pavements, shoulders or taxiways.

3.3 Work must be arranged so that contractor interference with traffic and building occupants is minimized. The contractor shall provide and maintain all necessary detour signs, barricades, and flag persons for rerouting traffic as directed by the C.O. and coordinated with the inspector who will notify security police 2 weeks in advance.

4. SPECIAL CONSIDERATIONS.

4.1 Clean Up. The contractor shall remove all equipment, rubble and rubbish from streets and parking lots open to traffic at the end of each workday. At the end of each project/D.O. all equipment, rubble and rubbish shall be completely removed from the base by the contractor, leaving the area in a safe, clean and orderly manner to the satisfaction of the C.O.

4.2 If there are any uncertainties with respect to elevations, location of new or existing utilities, or any other information in this contract, the contractor shall obtain clarification from the C.O. or his designated representative.

4.3 Hauling. Hauling across the four bridges on Gavin Mandery with large dump trucks (2 tons or greater) is prohibited. The haul route from housing (MFH) to other parts of the base shall be via Warren Shingle Road. See base map on sheet 1 of the drawings.

4. Photography is prohibited on or towards the airfield without prior written approval from the Government.

5. DISPOSAL OF REMOVED MATERIALS AND REFUSE.

5.1 There is no landfill at Beale AFB. The contractor shall haul all refuse and construction debris/rubble (including unground AC and concrete) to an off-base landfill and provide for their own refuse service.

5.2 The following items shall remain property of the government and shall be stock piled at a designated (by the inspector) location on base: removed base rock; removed suitable material (see 02100-3.4, *Suitable Material*). If removed asphalt concrete (AC) is ground-up sufficiently (3/a" max particle size), it may be placed, spread and graded by the contractor onto designated unimproved roads on base, as approved by the C.O. The quality of these materials shall be examined and approved by the inspector, prior to hauling. If the soil or gravel is not cleaned of roots, rock, rubble, or debris larger than 2" in any dimension, or if the AC is not ground up sufficiently, the contractor must haul these materials/loads off base. If after dumping at the designated location, these materials are found to contain impurities larger than the prescribed particle size, the contractor will be required to pick out, remove and dispose them off base. The contractor shall conform to the Beale AFB Soils Management Plan.

5.3 Hazardous Materials/Wastes (HM/HW).

5.3.1 Contractor shall be responsible for knowing which materials he is using or encounters that are hazardous material/waste, as well as for proper labeling, transportation and disposal procedures under County, State, and Federal regulations for hazardous material/waste. Coordinate with the base environmental office, 9 CES/CEV (634-2844), prior to HW generation for appropriate waste accountability, manifesting, storage and/or disposal. Any use of chemicals that result in a hazardous or toxic waste discharge must be pre-coordinated with the 9 CES/CEV.

5.3.2 If project specifications refer to another standard or agency specification (for example, a CalTrans specification or procedure), the contractor will be responsible for providing *material safety data sheets* (MSDS) for any chemical or toxic substance called for, and for coordinating with the C.O. in advance for the use and disposal of excess chemical and/or prevention of chemical-contaminated runoff. The contractor will obtain material safety data sheets for any chemical or toxic substance to be used, submit copies to the C.O. prior to use, and follow material safety data sheet instructions for any hazardous or toxic substances used. The contractor shall not store **HM/HW** on Beale AFB longer than 24 hours without written approval of the C.O. The C.O. will coordinate longer-than-24-hour storage with 9 CES/CEV.

5.3.3 Used creosote containers, waste creosote, soiled brushes, asbestos and solvents shall be removed by the contractor from the base and disposed of as hazardous waste in accordance with County, State, and Federal regulations.

5.4 Spill Cleanup. Contractor shall be required to containerize and clean up (to the satisfaction of the C.O. IAW State & County Regulations) any liquid spills he/she causes at the work site that might endanger or degrade human health or the environment. Containerization and cleanup shall be accomplished such that no petroleum product, toxic chemical or hazardous substances enters a creek, gutter, or appurtenance leading to natural drainage. This includes any chemicals or substances that cause soil staining or have other potential for air/water/soil degradation as determined by the base environmental coordinator and/or project manager. Coordinate use of any solvents, cleaners, or chemical cleaning or finishing agents with 9 CES/CEV for any outdoor work; for example, asphalt cleaning and/or finishing, roofing chemicals, etc. that could conceivably enter drainage systems or channels via rainfall and/or washing-off with water. The contractor should anticipate that any spills and discharges of deleterious substances will most likely be reported to and scrutinized by federal, state, or county environmental regulatory agencies; and that the contractor will be responsible for cleanup/remedial action according to agency specifications. Drips and leaks from mechanical equipment engines or hydraulic components should be containerized in drip pans. Any soil staining at the job site from such drips and leaks will require immediate cleanup (soil removal and disposal as hazardous waste) by the contractor at their own expense. Contractor must have available sufficient absorbent and/or spill cleanup materials for no less than a 50-gallon spill at the job site or anywhere on the base where his/her equipment may leak or cause spillage. Spill cleanup using government resources will be charged to the contractor at an amount determined by the C.O.

6. USE OF UTILITIES. Reasonable quantities of water shall be furnished to the contractor without charge via fire hydrants designated by 9 CES/CEOIU (634-3659/3605). The contractor shall be responsible for providing all materials and operations necessary to make connections and/or hookups to these hydrants. The contractor shall provide for their own sanitary facilities, telephone service, electrical power and lights.

7. UTILITY SHUTDOWNS. No exterior utility service shall be interrupted to make connections, to relocate, or for any purpose without approval of the C.O. Request for permission to shut down services shall be submitted, in writing, to the C.O. fourteen (14) calendar days prior to date of proposed interruption. The request shall give the service affected, the location, time and duration of shutoff. Report and utility breaks or damage immediately to the inspection staff.

8. SAFETY. The contractor shall conform to the latest edition of the Air Force Occupational Safety and Health Standards (AFOSH) developed in accordance with AFR 127-12. The C.O. may by written order, direct added AFOSH and safety and accident prevention standards as may be required. Trenching deeper than four feet must comply with OSHA 1910 & 1926. Open holes or trenches shall be barricaded or covered with plywood whenever left unattended by the contractor. Also, attention is directed to the requirements of AFOSH Standard 91-25, "Confined Spaces".

9. STORAGE AREAS. Storage areas for the contractor's vehicles, materials and equipment will be designated by the inspector; however, the government will take no responsibility for lost or stolen equipment or materials.

10. EMERGENCY ACCESS. Fire trucks and emergency equipment shall have emergency ingress and egress to all areas at all times.

11. AS-BUILT DRAWINGS. When encountered or at the time of installation, the locations of underground utilities shall be measured and recorded on a set of

plans, if different from that shown on the plans. The contractor shall locate, dimension and record all pertinent data such as: valve/box locations; connections to existing; material types; inverts or top of pipe elevations; pipe slopes or grades; depths; lengths; and so forth. Regarding existing underground utilities encountered, only the sections discovered need to be mapped. The contractor shall give the marked-up plans to the C.O. at the end of each delivery order.

12. DUST CONTROL. Take appropriate action to prevent the spread of dust to buildings and to avoid the creation of a nuisance in the surrounding area. Do not use water if it results in hazardous or objectionable conditions, such as flooding or pollution. Comply with all dust regulations imposed by local air pollution agencies, particularly Yuba County APCB Rule 3,3 (Dust and Fumes).

13. DIGGING PERMIT.

13.1 In order to avoid damaging any underground utilities, such as sewer, water, gas, electrical, telephone, cable TV, and possibly others, the contractor must obtain digging permits. The contractor shall process, obtain and maintain a digging permit required for any excavation, grading, or road patching work deeper than three inches (3"), prior to beginning construction. Underground Service Alert (USA) limits the number of work locations for each permit to three, however, one general location may have several sublocations such as at each corner of an intersection or the front and back of a facility. Depending on the project and determination by USA, the contractor is responsible for obtaining as many digging permits as required for a particular delivery order or contract.

13.2 The contractor shall obtain forms and initiate the digging permit process at Bldg 2539 (near Doolittle & B Sts), room 204, tel. 634-4531). The contractor must fill out each permit form (AF Form 103) with pertinent information and attach a plan showing the location of the respective work (contract drawings with areas highlighted is acceptable).

13.3 Also, as a part of the digging permit process, the contractor shall be required to mark all locations of excavation work on site with white spray paint. Existing utilities will be marked in the field by the respective agency in proposed construction areas. The contractor is required to maintain these markings (or reference points) so that the pertinent agency does not have to duplicate their work. Since the processing of a package of permits may take up to two weeks, the contractor must plan work accordingly.

14. EXCLUSION PERIOD. No work will be required during the winter months between November 1 and May 1 and such period has not been considered in computing the time allowed for completion. The contractor may perform work during any part of this period upon receiving approval from the C.O. During this period, the contractor must also notify the inspector at the start of each day he intends to work. The C.O. may revoke the right to work during this period for any reason at any time, for sake of efficiency or quality of product.

INDEX

SECTION 01100

SUBMITTAL REQUIREMENTS

1. SUBMITTALS
2. COPIES
3. TABLE KEY

SECTION 01100

SUBMITTAL REQUIREMENTS

1. SUBMITTALS. This section applies to the items listed in the table on the following pages and constitutes the list of required submittals and/or printed data for each delivery order under this contract.

2. Submittals shall be furnished in four (4) copies (UON) along with an AF Form 3000. One signed and dated copy of the Form 3000 will be returned to the contractor after approval or disapproval by the C.O. In no case will submitted items be incorporated into the work unless prior approval is obtained from the C.O. Copies of accepted submittals will be retained. All submittals must be furnished and accepted prior to final acceptance of the contract work and prior to processing invoice for final payment.

3. Table Key.

A =Certificates of Compliance

B =Shop Drawings/Sketches/As-builts (3 initial copies, final as-built copy on vellum)

C =Samples (one only)

D =Color Selection (two only)

E =Manufacturer's Recommendations

F =Manufacturer's Warranty/Guarantee

G =Manufacturer's Catalogue/Brochure and Pertinent Data

H = Operation and Maintenance Instructions including Parts List

I =Lab/Performance Test Results/Reports/Calculations/Logs

J =Material Safety Data Sheets/Disposal Plan

K = Demonstration Test/Test Strip

L = Videos/Photos

M = Manufacturer's stamp

ITEM	REFERENCE SECT/PARA	DATA REQ'D	DATE REC'D	SUSP. DATE	DATE RETND	APPRV YES/NO	KTR SUB#
Misc. Paints, Chemicals, Solvents, Etc.	01000-5.3.2	J					
Compaction Tests	02100-5.2	I					
Aggregate Base	02200-2.1	A					
Pavement Striping Paint	02200-2.5	A,D,G, J					
Joint Sealant	02300-2.1,2.2 2.3	E,G					
Pipe, Fittings & Couplings	02400-2.1	G					
Precast Concrete Products (DI's, CB's,etc)	02400-2.2 03100-2.4	G					
Filter Fabric	02400-2.3	G					
Fertilizer, Soil Amendments	02500-2.3	A,G or I					
Hydroseed mix, application	02500-2.3,2.4	A or G					
Concrete	03100-2.1	A					
Pavers	03100-2.7	D,G					
Spall Repair Mat'l	03200-2.1	E,G					
Grooving Test Strip	03300-2.6	K					
Redwood Fencing Materials	02600-3.1	A or M					

SECTION 01200
FIRE PREVENTION

SECTION 01200

FIRE PREVENTION

1. The following fire prevention practices are requirements for adherence by private contractors performing work on Beale AFB.
2. Prior to performing "Hot Work" (welding, burning, lead-melting, blow torches, tar pots, etc.), or operating other flame producing devices, the contractor shall request a Portable Gas/Arc Equipment Cutting and Welding Permit. The Fire Department Technical Services Section, tel. 634-8677, will issue this permit. The welding area will be checked for combustibles, including flammable liquids.
 - 2.1 All holes or spaces will be covered to prevent sparks or slag from entering.
 - 2.2 The contractor shall provide a suitable fire extinguisher.
 - 2.3 The area where "Hot Work" operations have been conducted will be thoroughly checked after work is completed.
 - 2.4 Tar kettles will be no closer than 20 feet from any building.
3. Oil painting materials (paint, brushes, empty paint cans, rags, paint clothes, drop cloths, etc.) and flammable liquids shall be removed from the building at the end of the workday. Such painting materials and flammable liquids shall be stored in a location approved by the C.O.
4. Accumulations of trash, paper, shavings, sawdust, excelsior, boxes and other packing materials shall be removed from the building at the close of each day. Also, the areas outside of buildings undergoing work shall be kept clear of trash and other discarded combustibles.
5. The storage of large quantities of combustible building materials, such as lumber or paper products, shall be kept in areas approved by the Fire Department.
6. All portable electric devices (saws, sanders, compressors, extension cords or lights) not required to be energized shall be disconnected at the end of each working day.
7. Any fire, NO MATTER HOW SMALL, shall be reported to the Fire Department immediately. Dial 911 for all emergencies on any base or commercial phone.
8. Fire hose or extinguishers in buildings shall not be removed from their locations or used for any purpose other than a fire.

9. Fire hydrants shall not be used without special permission from the Fire Department Technical Services Section, tel. 634-8677. If special permission is granted for the use of fire hydrants the contractor will use a suitable hydrant wrench for opening and closing the hydrant. Pipe wrenches will not be used. A clear space of fifteen (15) feet on both sides of fire hydrants shall be maintained at all times.

10. Smoking is strictly prohibited in or near areas where flammable liquids, highly combustible materials or explosives are stored, handled or processed. NO SMOKING signs will be observed and restrictions complied with.

11. The contractor or his designated representative will notify the Fire Department of any utility shut down that might affect an installed Fire Protection or Fire Detection System.

12. Prior to quitting time, the contractor shall make a check of the building or area to assure compliance with the above and insure that the building and area are left in a Fire Safe Condition.

13. Burning of trash and waste is strictly prohibited.

14. Bulk storage of gasoline is strictly prohibited.

15. The Base Fire Department is available for advice and assistance on any matters pertaining to Fire Prevention and Fire Protection--call Technical Services Section, tel. 634-8677.

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01320

PROJECT SCHEDULE

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 QUALIFICATIONS

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

- 3.1 GENERAL REQUIREMENTS
- 3.2 BASIS FOR PAYMENT
- 3.3 PROJECT SCHEDULE
 - 3.3.1 Use of the Critical Path Method
 - 3.3.2 Level of Detail Required
 - 3.3.2.1 Activity Durations
 - 3.3.2.2 Procurement Activities
 - 3.3.2.3 Government Activities
 - 3.3.2.4 Responsibility
 - 3.3.2.5 Work Areas
 - 3.3.2.6 Modification or Claim Number
 - 3.3.2.7 Bid Item
 - 3.3.2.8 Phase of Work
 - 3.3.2.9 Category of Work
 - 3.3.2.10 Feature of Work
 - 3.3.3 Scheduled Project Completion
 - 3.3.3.1 Project Start Date
 - 3.3.3.2 Constraint of Last Activity
 - 3.3.3.3 Early Project Completion
 - 3.3.4 Interim Completion Dates
 - 3.3.4.1 Start Phase
 - 3.3.4.2 End Phase
 - 3.3.4.3 Phase X
 - 3.3.5 Default Progress Data Disallowed
 - 3.3.6 Out-of-Sequence Progress
 - 3.3.7 Negative Lags
- 3.4 PROJECT SCHEDULE SUBMISSIONS
 - 3.4.1 Preliminary Project Schedule Submission
 - 3.4.2 Initial Project Schedule Submission
 - 3.4.3 Periodic Schedule Updates
 - 3.4.4 Standard Activity Coding Dictionary
- 3.5 SUBMISSION REQUIREMENTS
 - 3.5.1 Data Disks
 - 3.5.1.1 File Medium

- 3.5.1.2 Disk Label
- 3.5.1.3 File Name
- 3.5.2 Narrative Report
- 3.5.3 Approved Changes Verification
- 3.5.4 Schedule Reports
 - 3.5.4.1 Activity Report
 - 3.5.4.2 Logic Report
 - 3.5.4.3 Total Float Report
 - 3.5.4.4 Earnings Report
- 3.5.5 Network Diagram
 - 3.5.5.1 Continuous Flow
 - 3.5.5.2 Project Milestone Dates
 - 3.5.5.3 Critical Path
 - 3.5.5.4 Banding
 - 3.5.5.5 S-Curves
- 3.6 PERIODIC PROGRESS MEETINGS
 - 3.6.1 Meeting Attendance
 - 3.6.2 Update Submission Following Progress Meeting
 - 3.6.3 Progress Meeting Contents
 - 3.6.3.1 Start and Finish Dates
 - 3.6.3.2 Time Completion
 - 3.6.3.3 Cost Completion
 - 3.6.3.4 Logic Changes
 - 3.6.3.5 Other Changes
- 3.7 REQUESTS FOR TIME EXTENSIONS
 - 3.7.1 Justification of Delay
 - 3.7.2 Submission Requirements
 - 3.7.3 Additional Submission Requirements
- 3.8 DIRECTED CHANGES
- 3.9 OWNERSHIP OF FLOAT

-- End of Section Table of Contents --

SECTION 01320

PROJECT SCHEDULE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referenced in the text by basic designation only.

ENGINEERING REGULATIONS (ER)

ER 1-1-11 (1995) Progress, Schedules, and Network Analysis Systems

1.2 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS, a Project Schedule as described below shall be prepared. The scheduling of construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel will result in an inability of the Contracting Officer to evaluate Contractor's progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, the

Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the Project Schedule shall be capable of providing all requirements of this specification. Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer.

3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in the Precedence Diagram Method (PDM).

3.3.2 Level of Detail Required

The Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule. The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule:

3.3.2.1 Activity Durations

Contractor submissions shall follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods (usually less than 2 percent of all non-procurement activities' Original Durations are greater than 20 days).

3.3.2.2 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, and delivery.

3.3.2.3 Government Activities

Government and other agency activities that could impact progress shall be shown. These activities include, but are not limited to: approvals, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

3.3.2.4 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, contractor work force, or government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

3.3.2.5 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

3.3.2.6 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number. Whenever possible, changes shall be added to the schedule by adding new activities. Existing activities shall not normally be changed to reflect modifications.

3.3.2.7 Bid Item

All activities shall be identified in the project schedule by the Bid Item to which the activity belongs. An activity shall not contain work in more than one bid item. The bid item for each appropriate activity shall be identified by the Bid Item Code.

3.3.2.8 Phase of Work

All activities shall be identified in the project schedule by the phases of work in which the activity occurs. Activities shall not contain work in more than one phase of work. The project phase of each activity shall be by the unique Phase of Work Code.

3.3.2.9 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited, to the procurement chain of activities including such items as submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

3.3.2.10 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to, a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

3.3.3 Scheduled Project Completion

The schedule interval shall extend from NTP to the contract completion date.

3.3.3.1 Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.3.3 Early Project Completion

In the event the project schedule shows completion of the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted in the narrative report at every project schedule update period to assist the Contracting Officer in evaluating the Contractor's ability to actually complete prior to the contract period.

3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and a zero day duration.

3.3.4.2 End Phase

The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.4.3 Phase X

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Program features which calculate one of these parameters from the other shall be disabled.

3.3.6 Out-of-Sequence Progress

Activities that have posted progress without all preceding logic being satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case approval of the Contracting Officer. The Contractor shall propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule.

3.3.7 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

3.4.1 Preliminary Project Schedule Submission

The Preliminary Project Schedule, defining the Contractor's planned operations for the first 60 calendar days shall be submitted for approval within 20 calendar days after the NTP is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 60 calendar days after NTP.

3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 40 calendar days after NTP. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail.

3.4.3 Periodic Schedule Updates

Based on the result of progress meetings, specified in "Periodic Progress Meetings," the Contractor shall submit periodic schedule updates. These submissions shall enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgement of the Contracting Officer or authorized representative is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

3.4.4 Standard Activity Coding Dictionary

The Contractor shall use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used.

3.5 SUBMISSION REQUIREMENTS

The following items shall be submitted by the Contractor for the preliminary submission, initial submission, and every periodic project schedule update throughout the life of the project:

3.5.1 Data Disks

Two data disks containing the project schedule shall be provided. Data on the disks shall adhere to the SDEF format specified in ER 1-1-11, Appendix A.

3.5.1.1 File Medium

Required data shall be submitted on 3.5 disks, formatted to hold 1.44 MB of data, under the MS-DOS Version 5. or 6.x, unless otherwise approved by the Contracting Officer.

3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Preliminary, Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number or person responsible for the schedule, and the MS-DOS version used to format the disk.

3.5.1.3 File Name

Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the

Contracting Officer for approval.

3.5.2 Narrative Report

A Narrative Report shall be provided with the preliminary, initial, and each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to relay to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis.

3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float. Actual Start and Actual Finish Dates shall be printed for those activities in progress or completed.

3.5.4.1 Activity Report

A list of all activities sorted according to activity number.

3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in ascending order by activity number. Preceding and succeeding activities shall include all information listed above in paragraph Schedule Reports. A blank line shall be left between each activity grouping.

3.5.4.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates. Completed activities shall not be shown on this report.

3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the NTP until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the

field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by bid item and sorted by activity numbers. This report shall: sum all activities in a bid item and provide a bid item percent; and complete and sum all bid items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

3.5.5 Network Diagram

The network diagram shall be required on the initial schedule submission and on monthly schedule update submissions. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity number, description, duration, and estimated earned value shall be shown on the diagram.

3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.5.3 Critical Path

The critical path shall be clearly shown.

3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

3.5.5.5 S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly onsite meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor shall describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer will approve activity progress, proposed revisions,

and adjustments as appropriate.

3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost-to-Date shall be subject to the approval of the Contracting Officer. As a minimum, the Contractor shall address the following items on an activity by activity basis during each progress meeting.

3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish dates for each activity currently in-progress or completed .

3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations shall be based on Remaining Duration for each activity.

3.6.3.3 Cost Completion

The earnings for each activity started. Payment will be based on earnings for each in-progress or completed activity. Payment for individual activities will not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

3.6.3.4 Logic Changes

All logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) delays beyond the Contractor's control, such as strikes and unusual weather. 2) delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning

the work necessary. 3) Changes required to correct a schedule which does not represent the actual or planned prosecution and progress of the work.

3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor requests an extension of the contract completion date, or any interim milestone date, the Contractor shall furnish the following for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

3.7.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request.

The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, will not be a cause for a time extension to the contract completion date.

3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of under 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

- a. A list of affected activities, with their associated project schedule activity number.
- b. A brief explanation of the causes of the change.
- c. An analysis of the overall impact of the changes proposed.
- d. A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

3.7.3 Additional Submission Requirements

For any requested time extension of over 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

3.8 DIRECTED CHANGES

If the NTP is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01330

SUBMITTAL PROCEDURES

04/00

PART 1 GENERAL

- 1.1 SUBMITTAL IDENTIFICATION
- 1.2 SUBMITTAL CLASSIFICATION
 - 1.2.1 Government Approved
 - 1.2.2 Information Only
- 1.3 SUBMITTAL REVIEW AND APPROVAL
- 1.4 APPROVED SUBMITTALS
- 1.5 DISAPPROVED SUBMITTALS
- 1.6 SUBMITTALS
- 1.7 PAYMENT FOR ITEMS FOR WHICH A SUBMITTAL AND APPROVAL IS REQUIRED

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 SUBMITTAL REGISTER (ENG FORM 4288)
- 3.3 SCHEDULING
- 3.4 TRANSMITTAL FORM (ENG FORM 4025)
- 3.5 SUBMITTAL PROCEDURE
 - 3.5.1 Procedures
 - 3.5.1.1 Resubmittals
 - 3.5.2 Deviations
- 3.6 MECHANICAL ROOM LAYOUT DRAWINGS
- 3.7 SPARE PARTS LIST AND MAINTENANCE OPERATIONS MANUALS
- 3.8 AS-BUILT DRAWINGS
- 3.9 GEOTECHNICAL AND CONCRETE MATERIALS REPORT
- 3.10 CONTROL OF SUBMITTALS
- 3.11 GOVERNMENT APPROVED SUBMITTALS
- 3.12 INFORMATION ONLY SUBMITTALS

-- End of Section Table of Contents --

SECTION 01330

SUBMITTAL PROCEDURES

04/00

PART 1 GENERAL

1.1 SUBMITTAL IDENTIFICATION

Submittals required are identified by SD numbers as follows:

SD-01 Data

SD-04 Drawings

SD-06 Instructions

SD-07 Schedules

SD-08 Statements

SD-09 Reports

SD-13 Certificates

SD-14 Samples

SD-18 Records

SD-19 Operation and Maintenance Manuals

1.2 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.2.1 Government Approved

Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.2.2 Information Only

All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.3 SUBMITTAL REVIEW AND APPROVAL

1.4 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.5 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.6 SUBMITTALS

The Contractor may be required to mail Submittals to multiple locations as directed. The location(s) for Government review of Contractor Submittals will be determined at a meeting between the Contractor and the Administrative Contracting Officer.

1.7 PAYMENT FOR ITEMS FOR WHICH A SUBMITTAL AND APPROVAL IS REQUIRED

In accordance with FAR 52.232-5, "Payments Under Fixed-Price Construction Contracts", the Government shall make progress payments to the Contractor monthly based on estimates of work accomplished which meets the standards of quality established under the contract. On items for which submittals must be approved by the Contracting Officer, payment cannot be made for the item until the Government establishes that the item "meets the standards of quality" required by the contract. The Contractor shall not invoice for, nor shall the Government make payment for any item, for which submittal and approval is required, until the item has been submitted and approved as described herein.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) System Manager and each item shall be stamped, signed, and dated by the CQC System Manager indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

Submittals of all architectural finishes shall all be submitted at the same time so that they may be evaluated as a whole in comparison with the specified coordinated finishes. See Paragraph COLOR BOARDS for additional requirements of submittals.

3.2 SUBMITTAL REGISTER (ENG FORM 4288)

3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 35 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals.

3.4 TRANSMITTAL FORM (ENG FORM 4025)

The Contractor shall complete ENG Form 4025, "Transmittal of Shop Drawings, Equipment Data, Material Samples, or Manufacturer's Certificates of Compliance" and forward six (6) copies of same with each set of shop drawings, certificates of compliance, materials, fixtures and equipment lists submitted for approval. Four (4) copies of the ENG Form 4025 shall be submitted for information only data. No translucent or coated reproduced copies will be accepted. Each item submitted shall be listed separately on the ENG Form 4025. For new submittals or resubmittals mark the appropriate box; or resubmittals also insert previous transmittal number. Blank ENG Forms 4025 will be furnished by the Contracting Officer on request. Shop drawings shall be either blue line or black line prints on a white background. Blueprints are not acceptable. Each submittal shall be identified with the Contractor's name, Contract Number, Transmittal Number, and Item Number to correspond with Item Number listed on ENG Form 4288. The following identification shall be marked on submittals as applicable:

- Contract Number
- Project Title and Location
- Subcontractor's Name
- Supplier's Name or Manufacturer's Name
- Specification Section and Paragraph Number
- Contract Drawing File Number

Shop drawings shall be incorporated into the Final As-Built drawing set as defined under Paragraph 3.9 As-Built Drawings. This includes electronic versions of the shop drawings.

3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

3.5.1 Procedures

Submittals required by the CONTRACT CLAUSES and other non-technical parts of the contract are not included in this section. The Contractor shall submit to the Contracting Officer: six (6) copies for approval, and four (4) copies for information only, of all shop drawings, certificates of compliance, materials, fixtures and equipment lists called for under the various headings of these specifications. These drawings, certificates and lists shall be complete and detailed and, prior to submission, must be reviewed and certified correct by the Contractor as required by the Quality Control System paragraph of the Construction Quality Control Section. If approved by the Contracting Officer, four (4) sets of all submittals will be retained by the Contracting Officer and two (2) sets will be returned to the Contractor. Submittals for information only usually will not be returned. The Contractor is encouraged to submit paper documents that are printed/copied double-sided on recycled paper that has at least 20% postconsumer material.

3.5.1.1 Resubmittals

If a submittal is returned for correction or is not satisfactory and is disapproved by the Contracting Officer, the Contractor shall resubmit the corrected material in the same quantity, including reproducibles as specified for the original submittal for approval within 14 days after receipt by him of the disapproved material.

3.5.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3.6 MECHANICAL ROOM LAYOUT DRAWINGS

The Contractor shall submit a layout drawing, including appropriate elevations and sections as required, for each Mechanical Room showing the room arrangement he proposes for all pieces of equipment and appurtenances thereto (via., air-conditioning equipment, boilers, compressors, hot water tanks, pumps, electrical control panels, ducts, piping, etc.), that are to be located in the room. The Mechanical Room floor slab will not be placed until the complete Mechanical Room layout drawing has been submitted and approved. No payment will be made to the Contractor for any of the equipment for the room or its installation until these drawings have been approved. Mechanical Room Layout Drawings shall be identified and submitted in the manner specified for "Shop Drawings". Equipment rooms shown on the drawings are of adequate size to accommodate equipment of required capacities, as available from several manufacturers, with sufficient space left for access, servicing, removal, etc. The use of equipment items with dimensions such as to crowd the space will not be permitted.

3.7 SPARE PARTS LIST AND MAINTENANCE OPERATIONS MANUALS

Within 30 calendar days after approval of shop drawings and equipment lists, the Contractor shall submit, to the Contracting Officer, [[3][6]] copies of spare parts lists and operating and maintenance manuals as required under the various headings of these specifications. [One reproducible, unfolded copy shall be provided of all operating instructions, control diagrams, etc., that are larger than 8-1/2-inches by 11-inches; this does not apply to standard manufacturer's data.]

(A) Spare parts lists shall contain the following listed information:

(1) Quantity of parts required for 120 days and one year of operation.

- (2) Description of each spare part.
- (3) Drawing number and shop drawing reference.
- (4) Part equipment code number.
- (5) Unit price of each item.
- (6) Total price of all items.
- (7) Procurement lead time with particular attention to long lead times.
- (8) Name and address of nearest supplier.
- (9) Such remarks and data as the manufacturer may consider pertinent.
- (10) Complete parts list of all replaceable items.

(B) Operation, Maintenance, and Repair Manuals and Instructions:

(1) The requirements for furnishing operating, maintenance, and repair data/manuals and field instructions under this contract are specified in the Technical Specifications. The Contractor shall submit to the Contracting Officer, not later than 60 calendar days after the Notice to Proceed, an outline showing the proposed submittal date(s) of operation and maintenance manuals to be furnished the Government and the scheduled date(s) of all required field instructions to be provided by Contractor furnished personnel or manufacturer's representatives. All operation and maintenance manuals must be furnished to the Contracting Officer not later than 60 calendar days prior to turnover of the facility to the Government.

(1) The first time submittal requirements for furnishing operating, maintenance, and repair data/manuals and field instructions under this contract are specified in the Technical Specifications. The Contractor shall submit to the Contracting Officer, not later than 60 calendar days after the Notice to Proceed, an outline showing the proposed submittal date(s) of operation and maintenance manuals to be furnished the Government and the scheduled date(s) of all required field instructions to be provided by Contractor furnished personnel or manufacturer's representatives. All operation and maintenance manuals must be furnished to the Contracting Officer at final inspection.

(2) Failure on the part of the Contractor to comply with requirements of this clause will result in no further payment until all required O&M data/manuals are submitted and accepted.

(3) All O&M data/manuals submittal data shall be entered in a separate section of the master submittal register. Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. (4)

copies of the submittal will be retained by the Contracting Officer and (2) copies of the submittal will be returned to the Contractor.

3.8 AS-BUILT DRAWINGS

(Specific instructions may be obtained from Internet Address:
<http://www.cbbs.spk.usace.army.mil/html/aeguide.html>)

These instructions include submittal requirements for as-built and shop drawings. All other submittals and O&M Manuals will be reviewed and submitted as per other Technical Specification Section requirements.

(A) Working As-Built Drawings (Government Approved - See ATTACHMENT - CONTRACTOR PREPARED AS-BUILTS). The Contractor shall maintain a current record of the work as actually constructed in the form of working as-built drawings. These will typically be red-line mark-ups of the construction plans. Three sets of red-line markups shall be submitted after the completion of work at 25% intervals (i.e. 25%, 50%, 75%, and 100%), for bid items, if appropriate, or with more frequent intervals as determined by the Contracting Officer, in conjunction with approval of progress payments. It is the Contractor's responsibility to ensure the use of the most current drawings. Subject to the approval of the Contracting Officer, a member of the Contractor's Quality Control Organization will be assigned the sole responsibility for the maintenance and currency of the as-built drawings. Any reassignment of duties concerning the maintenance of the as-built drawings will be promptly reported to the Contracting Officer. Guidelines and drafting standards for preparing working and final as-built drawings can be found on the Internet.

(B) Final As-Built Drawings (Government Approved - See ATTACHMENT - CONTRACTOR PREPARED AS-BUILTS). The Contractor shall prepare final As-Built drawings which depict the actual conditions upon completion of construction. The deliverable required shall be in both hard copy and electronic format. Hard copies of the final As-Built Drawings shall be printed from the final approved CADD files.

(C) End-User (Customer) Requirements

1. CADD Format.

AutoCAD Release 14 for use on NT 4.0 Operating System (No conversion of format will be allowed.)

2. Hard Copy Media and Quantities.

One half-size (2) half-size 11" x 17" on bond].

(D) Delivering electronic files.

Specific instructions for labeling disks or CD-ROMs, directory structure, indexing and additional documentation requirements are listed on the Internet.

(Internet Address: <http://www.cbbs.spk.usace.army.mil/html/aeguide.html>)

3.9 GEOTECHNICAL AND CONCRETE MATERIALS REPORT

Contractor shall prepare an as constructed geotechnical and concrete materials report for project. For additional information see (Internet Address:

<http://www.usace.army.mil/inet/usace-docs/eng-regs/er1110-1-1901/toc.htm>).

3.10 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.11 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. Four (4) copies of the submittal will be retained by the Contracting Officer and two (2) copies of the submittal will be returned to the Contractor.

3.12 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

-- End of Section --

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

--	--

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

02300

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

Water Treatment Plant

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

02821

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

02930

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

02950

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

03150

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

03300

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

05120

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

--	--

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

06610

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

2

CONTRACTOR
ACTION

GOVERNMENT ACTION	
----------------------	--

REMARKS

10

--	--

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

07200

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

07220

CONTRACTOR

Water Treatment Plant

ACTIVITY NO a.	TRANSMITTAL NO. b.	ITEM NO c.	SPECIFICATION PARAGRAPH NUMBER d.	DESCRIPTION OF ITEM SUBMITTED e.	TYPE OF SUBMITTAL												CLASSIFICATION	REVIEWER r.	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		GOVERNMENT ACTION		REMARKS aa.			
					DRAWING DATA f.	INSTRUMENT CONTROLS g.	STATEMENTS h.	REPORTS i.	CERTIFICATIONS j.	SAMPLING k.	RECORDS l.	O&M m.	INFORMATION n.	GOVERNMENT o.	SUBMIT p.	APPROVAL NEEDED BY q.	MATERIAL NEEDED BY r.		CODE v.	DATE w.	SUBMIT TO GOVERNMENT x.	CODE y.	DATE z.						
			1.2	Product Data	X											X													

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

--	--

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

2

CONTRACTOR
ACTION

GOVERNMENT ACTION	
----------------------	--

REMARKS

	X
--	---

	X
--	---

(ER 415 1-10)

SPECIFICATION SECTION	
-----------------------	--

07900

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

2

CONTRACTOR
ACTION

GOVERNMENT ACTION	
----------------------	--

REMARKS

aa.

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

TITLE AND LOCATION

Water Treatment Plant

CONTRACTOR

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

--	--

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

	CONTRACTOR SCHEDULE DATES
--	------------------------------

CONTRACTOR ACTION

GOVERNMENT ACTION	
----------------------	--

aa.

DATE _____

1

10

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

09650

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

09900

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

--	--

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

09960

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

2

CONTRACTOR
ACTION

GOVERNMENT ACTION	
----------------------	--

REMARKS

X

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

10800

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

11001

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

2

CONTRACTOR
ACTION

GOVERNMENT ACTION	
----------------------	--

REMARKS

1

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

11215

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

PAGE 1 OF 1 PAGES

(ER 415 1-10)

SPECIFICATION SECTION

11353

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

11355

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

13080

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

2

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

13405

CONTRACTOR

Water Treatment Plant

ENG FORM 4288 Jul 96

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

13416

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

PAGE 1 OF 1 PAGES

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

13850

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

15070

CONTRACTOR

Water Treatment Plant

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

15400

CONTRACTOR

Water Treatment Plant

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

PAGE 1 OF 1 PAGES

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

CONTRACTOR

2	
---	--

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

16264

CONTRACTOR

Water Treatment Plant

ACTIVITY NO.	TRANSMITTAL NO.	ITEM NO.	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL													CLASSIFICATION		CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		GOVERNMENT ACTION		REMARKS
					DRAWINGS	INSTRUMENTATION	STATEMENTS	REPORTS	CERTIFICATIONS	RECORDS	MANUALS	INFORMATION	GOVERNMENT	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE			DATE	SUBMIT TO GOVERNMENT	CODE	DATE				
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.	
			1.4	Equipment Performance	X										X												
			1.4	Sound Power Level	X																						
			1.4	Generator Data	X										X												
			1.4	Day Tank and Integral Main Fuel	X										X												
				Storage Tank Capacity																							
			1.4	Power Factor Capability Curve	X										X												
			1.4	Alarm Setpoints	X										X												
			1.4	Manufacturer's Catalog Data	X										X												
			1.4	Vibration-Isolation	X										X												
			1.4	Layout and Shop Drawings		X									X												
			1.4	As-Built Drawings		X									X												
			1.4	Posted Data			X																				
			1.4	Instructions			X																				
			1.4	Installation Procedures				X							X												
			1.4	Onsite Test					X							X											
			1.4	Reliability and Durability						X					X												
			1.4	Emissions						X						X											
			1.4	Sound limitation						X																	
			1.4	GA.						X																	
			1.4	Site Visit						X					X												
			1.4	Flywheel Balance						X					X												
			1.4	Standards Compliance						X					X												
			1.4	Factory Tests						X					X												
			1.4	Functional Facilities						X					X												

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

TITLE AND LOCATION

Water Treatment Plant

CONTRACTOR

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

16375

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

	SPECIFICATION SECTION
--	-----------------------

16415

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT ACTION	
----------------------	--

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

16710

CONTRACTOR

Water Treatment Plant

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

16711

CONTRACTOR

Water Treatment Plant

[illegible]

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01355

ENVIRONMENT PROTECTION

PART 1 GENERAL

- 1.1 GENERAL REQUIREMENTS
 - 1.1.1 Subcontractors
 - 1.1.2 Environmental Protection Plan
 - 1.1.3 Permits
 - 1.1.4 Preconstruction Survey
 - 1.1.5 Meetings
 - 1.1.6 Notification
 - 1.1.7 Litigation
 - 1.1.8 Previously Used Equipment
 - 1.1.9 Payment
- 1.2 LAND RESOURCES
 - 1.2.1 Work Area Limits
 - 1.2.2 Unprotected Erodible Soils
 - 1.2.3 Disturbed Areas
 - 1.2.4 Contractor Facilities and Work Areas
- 1.3 WATER RESOURCES
 - 1.3.1 Washing and Curing Water
 - 1.3.2 Cofferdam and Diversion Operations
 - 1.3.3 Stream Crossings
 - 1.3.4 Fish and Wildlife
- 1.4 AIR RESOURCES
 - 1.4.1 Particulates
 - 1.4.2 Hydrocarbons and Carbon Monoxide
 - 1.4.3 Odors
 - 1.4.4 Sound Intrusions
- 1.5 WASTE DISPOSAL
 - 1.5.1 Solid Wastes
 - 1.5.2 Chemical Wastes
 - 1.5.3 Hazardous Wastes
 - 1.5.4 Burning
- 1.6 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES
- 1.7 POST CONSTRUCTION CLEANUP
- 1.8 RESTORATION OF LANDSCAPE DAMAGE
- 1.9 MAINTENANCE OF POLLUTION FACILITIES
- 1.10 TRAINING OF CONTRACTOR PERSONNEL

-- End of Section Table of Contents --

SECTION 01355

ENVIRONMENT PROTECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

The Contractor shall perform the work minimizing environmental pollution and damage as the result of construction operations. Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of land, water, and air, and includes management of visual aesthetics, noise, solid waste, as well as other pollutants. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract.

1.1.1 Subcontractors

The Contractor shall ensure compliance with this section by subcontractors.

1.1.2 Environmental Protection Plan

The Contractor shall submit an environmental protection plan within 15 days after receipt of the notice to proceed. Approval of the Contractor's plan will not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures. The environmental protection plan shall include, but shall not be limited to, the following:

- a. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
- b. Methods for protection of features to be preserved within authorized work areas like trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archaeological, and cultural resources.
- c. Procedures to be implemented to provide the required environmental protection, to comply with the applicable laws and regulations, and to correct pollution due to accident, natural causes, or failure to follow the procedures of the environmental protection plan.

- d. Location of the solid waste disposal area.
- e. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials.
- f. Environmental monitoring plans for the job site, including land, water, air, and noise monitoring.
- g. Traffic control plan including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather, and the amount of mud transported onto paved public roads by vehicles or runoff.
- h. Methods of protecting surface and ground water during construction activities.
- i. Plan showing the proposed activity in each portion of the work area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas.
- j. Drawing of borrow area location. Protection measures required at the work site shall apply to the borrow areas including final restoration for subsequent beneficial use of the land.
- k. A recycling and waste prevention plan with a list of measures to reduce consumption of energy and natural resources; for example: the possibility to shred fallen trees and use them as mulch shall be considered as an alternative to burning or burial.
- l. A settling pond removal plan 120 days prior to removal work. The plan shall include the method of removing and testing of the collected sediment.
- m. Training for Contractor's personnel during the construction period.

1.1.3 Permits

The Contractor shall obtain all needed permits or licenses. The Government will not obtain any permits for this project; see Contract Clause PERMITS AND RESPONSIBILITIES. The State department of natural resources, through the national pollutant discharge elimination system (NPDES), requires general permits, a notice of intent, and a notice of discontinuation. The Contractor shall be responsible for implementing the terms and requirements of the appropriate permits as needed and for payment of all fees.

1.1.4 Preconstruction Survey

Prior to starting any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs and grassed areas immediately adjacent to work

sites and adjacent to the assigned storage area and access routes as applicable. This report will be signed by both the Contracting Officer and the Contractor upon mutual agreement as to its accuracy and completeness.

1.1.5 Meetings

The Contractor shall meet with representatives of the Contracting Officer to alter the environmental protection plan as needed for compliance with the environmental pollution control program.

1.1.6 Notification

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the previously mentioned Federal, State or local laws or regulations, permits, and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action when approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspensions.

1.1.7 Litigation

If work is suspended, delayed, or interrupted due to a court order of competent jurisdiction, the Contracting Officer will determine whether the order is due in any part to the acts or omissions of the Contractor, or subcontractors at any tier, not required by the terms of the contract. If it is determined that the order is not due to Contractor's failing, such suspension, delay, or interruption shall be considered as ordered by the Contracting Officer in the administration of the contract under the contract clause SUSPENSION OF WORK.

1.1.8 Previously Used Equipment

The Contractor shall thoroughly clean all construction equipment previously used at other sites before it is brought into the work areas, ensuring that soil residuals are removed and that egg deposits from plant pests are not present; the Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements.

1.1.9 Payment

No separate payment will be made for work covered under this section; all costs associated with this section shall be included in the contract unit and/or lump sum prices in the Bidding Schedule.

1.2 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify the land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be

cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without permission. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, earth or other material displaced into uncleared areas shall be removed.

1.2.1 Work Area Limits

Prior to any construction, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

1.2.2 Unprotected Erodible Soils

Earthwork brought to final grade shall be finished as indicated. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in cases where the constructed feature obscures borrow areas, quarries, and waste material areas, these areas shall not initially be totally cleared. Clearing of such areas shall progress in reasonably sized increments as needed to use the developed areas as approved by the Contracting Officer.

1.2.3 Disturbed Areas

The Contractor shall effectively prevent erosion and control sedimentation through approved methods including, but not limited to, the following:

- a. Retardation and control of runoff. Runoff from the construction site or from storms shall be controlled, retarded, and diverted to protected drainage courses by means of diversion ditches, benches, berms, and by any measures required by area wide plans under the Clean Water Act.
- b. Erosion and sedimentation control devices. The Contractor shall construct or install temporary and permanent erosion and sedimentation control features as indicated on the drawings. Berms, dikes, drains, sedimentation basins, grassing, and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.

1.2.4 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and

temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Borrow areas shall be managed to minimize erosion and to prevent sediment from entering nearby waters. Spoil areas shall be managed and controlled to limit spoil intrusion into areas designated on the drawings and to prevent erosion of soil or sediment from entering nearby waters. Spoil areas shall be developed in accordance with the grading plan indicated on the drawings. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas from despoilment.

1.3 WATER RESOURCES

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation when such application may cause contamination of the fresh water reserve. Monitoring of water areas affected by construction shall be the Contractor's responsibility. All water areas affected by construction activities shall be monitored by the Contractor.

1.3.1 Washing and Curing Water

Waste waters directly derived from construction activities shall not be allowed to enter water areas. Waste waters shall be collected and placed in retention ponds where suspended material can be settled out or the water evaporates to separate pollutants from the water. Analysis shall be performed and results reviewed and approved before water in retention ponds is discharged.

1.3.2 Cofferdam and Diversion Operations

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure shall be controlled at all times to limit the impact of water turbidity on the habitat for wildlife and on water quality for downstream use.

1.3.3 Stream Crossings

Stream crossings shall allow movement of materials or equipment without violating water pollution control standards of the Federal, State or local government.

1.3.4 Fish and Wildlife

The Contractor shall minimize interference with, disturbance to, and damage of fish and wildlife. Species that require specific attention along with measures for their protection shall be listed by the Contractor prior to beginning of construction operations.

1.4 AIR RESOURCES

Equipment operation and activities or processes performed by the Contractor in accomplishing the specified construction shall be in accordance with the

State's rules and all Federal emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency shall be maintained. Monitoring of air quality shall be the Contractor's responsibility. All air areas affected by the construction activities shall be monitored by the Contractor. Monitoring results will be periodically reviewed by the Government to ensure compliance.

1.4.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

1.4.2 Hydrocarbons and Carbon Monoxide

Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

1.4.3 Odors

Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

1.4.4 Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise. The Contractor shall comply with the provisions of the rules.

1.5 WASTE DISPOSAL

Disposal of wastes shall be as specified in Section 02050 DEMOLITION and as specified below.

1.5.1 Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property

and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal.

1.5.2 Chemical Wastes

Chemicals shall be dispensed ensuring no spillage to ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste shall be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 6 inches of the top. Wastes shall be disposed of in accordance with Federal and local laws and regulations.

1.5.3 Hazardous Wastes

The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing and shall collect waste in suitable containers observing compatibility. The Contractor shall transport hazardous waste off Government property and dispose of it in compliance with Federal and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Contracting Officer. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility.

1.5.4 Burning

Burning will be allowed only if permitted in other sections of the specifications or authorized in writing by the Contracting Officer. The specific time, location, and manner of burning shall be subject to approval. Fires shall be confined to a closed vessel, guarded at all times, and shall be under constant surveillance until they have burned out or have been extinguished. Burning shall be thorough reducing the materials to ashes.

1.6 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Existing historical, archaeological, and cultural resources within the Contractor's work area will be so designated by the Contracting Officer if any has been identified. The Contractor shall take precautions to preserve all such resources as they existed at the time they were first pointed out.

The Contractor shall provide and install protection for these resources and be responsible for their preservation during the life of the contract. If during excavation or other construction activities any previously unidentified or unanticipated resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer.

1.7 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction.

1.8 RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work areas.

1.9 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

1.10 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental pollution control.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01355

ENVIRONMENT PROTECTION

PART 1 GENERAL

- 1.1 GENERAL REQUIREMENTS
 - 1.1.1 Subcontractors
 - 1.1.2 Environmental Protection Plan
 - 1.1.3 Permits
 - 1.1.4 Preconstruction Survey
 - 1.1.5 Meetings
 - 1.1.6 Notification
 - 1.1.7 Litigation
 - 1.1.8 Previously Used Equipment
 - 1.1.9 Payment
- 1.2 LAND RESOURCES
 - 1.2.1 Work Area Limits
 - 1.2.2 Unprotected Erodible Soils
 - 1.2.3 Disturbed Areas
 - 1.2.4 Contractor Facilities and Work Areas
- 1.3 WATER RESOURCES
 - 1.3.1 Washing and Curing Water
 - 1.3.2 Cofferdam and Diversion Operations
 - 1.3.3 Stream Crossings
 - 1.3.4 Fish and Wildlife
- 1.4 AIR RESOURCES
 - 1.4.1 Particulates
 - 1.4.2 Hydrocarbons and Carbon Monoxide
 - 1.4.3 Odors
 - 1.4.4 Sound Intrusions
- 1.5 WASTE DISPOSAL
 - 1.5.1 Solid Wastes
 - 1.5.2 Chemical Wastes
 - 1.5.3 Hazardous Wastes
 - 1.5.4 Burning
- 1.6 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES
- 1.7 POST CONSTRUCTION CLEANUP
- 1.8 RESTORATION OF LANDSCAPE DAMAGE
- 1.9 MAINTENANCE OF POLLUTION FACILITIES
- 1.10 TRAINING OF CONTRACTOR PERSONNEL

-- End of Section Table of Contents --

SECTION 01355

ENVIRONMENT PROTECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

The Contractor shall perform the work minimizing environmental pollution and damage as the result of construction operations. Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of land, water, and air, and includes management of visual aesthetics, noise, solid waste, as well as other pollutants. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract.

1.1.1 Subcontractors

The Contractor shall ensure compliance with this section by subcontractors.

1.1.2 Environmental Protection Plan

The Contractor shall submit an environmental protection plan within 15 days after receipt of the notice to proceed. Approval of the Contractor's plan will not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures. The environmental protection plan shall include, but shall not be limited to, the following:

- a. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
- b. Methods for protection of features to be preserved within authorized work areas like trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archaeological, and cultural resources.
- c. Procedures to be implemented to provide the required environmental protection, to comply with the applicable laws and regulations, and to correct pollution due to accident, natural causes, or failure to follow the procedures of the environmental protection plan.

- d. Location of the solid waste disposal area.
- e. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials.
- f. Environmental monitoring plans for the job site, including land, water, air, and noise monitoring.
- g. Traffic control plan including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather, and the amount of mud transported onto paved public roads by vehicles or runoff.
- h. Methods of protecting surface and ground water during construction activities.
- i. Plan showing the proposed activity in each portion of the work area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas.
- j. Drawing of borrow area location. Protection measures required at the work site shall apply to the borrow areas including final restoration for subsequent beneficial use of the land.
- k. A recycling and waste prevention plan with a list of measures to reduce consumption of energy and natural resources; for example: the possibility to shred fallen trees and use them as mulch shall be considered as an alternative to burning or burial.
- l. A settling pond removal plan 120 days prior to removal work. The plan shall include the method of removing and testing of the collected sediment.
- m. Training for Contractor's personnel during the construction period.

1.1.3 Permits

The Contractor shall obtain all needed permits or licenses. The Government will not obtain any permits for this project; see Contract Clause PERMITS AND RESPONSIBILITIES. The State department of natural resources, through the national pollutant discharge elimination system (NPDES), requires general permits, a notice of intent, and a notice of discontinuation. The Contractor shall be responsible for implementing the terms and requirements of the appropriate permits as needed and for payment of all fees.

1.1.4 Preconstruction Survey

Prior to starting any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs and grassed areas immediately adjacent to work

sites and adjacent to the assigned storage area and access routes as applicable. This report will be signed by both the Contracting Officer and the Contractor upon mutual agreement as to its accuracy and completeness.

1.1.5 Meetings

The Contractor shall meet with representatives of the Contracting Officer to alter the environmental protection plan as needed for compliance with the environmental pollution control program.

1.1.6 Notification

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the previously mentioned Federal, State or local laws or regulations, permits, and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action when approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspensions.

1.1.7 Litigation

If work is suspended, delayed, or interrupted due to a court order of competent jurisdiction, the Contracting Officer will determine whether the order is due in any part to the acts or omissions of the Contractor, or subcontractors at any tier, not required by the terms of the contract. If it is determined that the order is not due to Contractor's failing, such suspension, delay, or interruption shall be considered as ordered by the Contracting Officer in the administration of the contract under the contract clause SUSPENSION OF WORK.

1.1.8 Previously Used Equipment

The Contractor shall thoroughly clean all construction equipment previously used at other sites before it is brought into the work areas, ensuring that soil residuals are removed and that egg deposits from plant pests are not present; the Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements.

1.1.9 Payment

No separate payment will be made for work covered under this section; all costs associated with this section shall be included in the contract unit and/or lump sum prices in the Bidding Schedule.

1.2 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify the land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be

cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without permission. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, earth or other material displaced into uncleared areas shall be removed.

1.2.1 Work Area Limits

Prior to any construction, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

1.2.2 Unprotected Erodible Soils

Earthwork brought to final grade shall be finished as indicated. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in cases where the constructed feature obscures borrow areas, quarries, and waste material areas, these areas shall not initially be totally cleared. Clearing of such areas shall progress in reasonably sized increments as needed to use the developed areas as approved by the Contracting Officer.

1.2.3 Disturbed Areas

The Contractor shall effectively prevent erosion and control sedimentation through approved methods including, but not limited to, the following:

- a. Retardation and control of runoff. Runoff from the construction site or from storms shall be controlled, retarded, and diverted to protected drainage courses by means of diversion ditches, benches, berms, and by any measures required by area wide plans under the Clean Water Act.
- b. Erosion and sedimentation control devices. The Contractor shall construct or install temporary and permanent erosion and sedimentation control features as indicated on the drawings. Berms, dikes, drains, sedimentation basins, grassing, and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.

1.2.4 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and

temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Borrow areas shall be managed to minimize erosion and to prevent sediment from entering nearby waters. Spoil areas shall be managed and controlled to limit spoil intrusion into areas designated on the drawings and to prevent erosion of soil or sediment from entering nearby waters. Spoil areas shall be developed in accordance with the grading plan indicated on the drawings. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas from despoilment.

1.3 WATER RESOURCES

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation when such application may cause contamination of the fresh water reserve. Monitoring of water areas affected by construction shall be the Contractor's responsibility. All water areas affected by construction activities shall be monitored by the Contractor.

1.3.1 Washing and Curing Water

Waste waters directly derived from construction activities shall not be allowed to enter water areas. Waste waters shall be collected and placed in retention ponds where suspended material can be settled out or the water evaporates to separate pollutants from the water. Analysis shall be performed and results reviewed and approved before water in retention ponds is discharged.

1.3.2 Cofferdam and Diversion Operations

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure shall be controlled at all times to limit the impact of water turbidity on the habitat for wildlife and on water quality for downstream use.

1.3.3 Stream Crossings

Stream crossings shall allow movement of materials or equipment without violating water pollution control standards of the Federal, State or local government.

1.3.4 Fish and Wildlife

The Contractor shall minimize interference with, disturbance to, and damage of fish and wildlife. Species that require specific attention along with measures for their protection shall be listed by the Contractor prior to beginning of construction operations.

1.4 AIR RESOURCES

Equipment operation and activities or processes performed by the Contractor in accomplishing the specified construction shall be in accordance with the

State's rules and all Federal emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency shall be maintained. Monitoring of air quality shall be the Contractor's responsibility. All air areas affected by the construction activities shall be monitored by the Contractor. Monitoring results will be periodically reviewed by the Government to ensure compliance.

1.4.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

1.4.2 Hydrocarbons and Carbon Monoxide

Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

1.4.3 Odors

Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

1.4.4 Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise. The Contractor shall comply with the provisions of the rules.

1.5 WASTE DISPOSAL

Disposal of wastes shall be as specified in Section 02050 DEMOLITION and as specified below.

1.5.1 Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property

and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal.

1.5.2 Chemical Wastes

Chemicals shall be dispensed ensuring no spillage to ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste shall be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 6 inches of the top. Wastes shall be disposed of in accordance with Federal and local laws and regulations.

1.5.3 Hazardous Wastes

The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing and shall collect waste in suitable containers observing compatibility. The Contractor shall transport hazardous waste off Government property and dispose of it in compliance with Federal and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Contracting Officer. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility.

1.5.4 Burning

Burning will be allowed only if permitted in other sections of the specifications or authorized in writing by the Contracting Officer. The specific time, location, and manner of burning shall be subject to approval. Fires shall be confined to a closed vessel, guarded at all times, and shall be under constant surveillance until they have burned out or have been extinguished. Burning shall be thorough reducing the materials to ashes.

1.6 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Existing historical, archaeological, and cultural resources within the Contractor's work area will be so designated by the Contracting Officer if any has been identified. The Contractor shall take precautions to preserve all such resources as they existed at the time they were first pointed out.

The Contractor shall provide and install protection for these resources and be responsible for their preservation during the life of the contract. If during excavation or other construction activities any previously unidentified or unanticipated resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer.

1.7 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction.

1.8 RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work areas.

1.9 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

1.10 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental pollution control.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01451

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 PAYMENT

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

- 3.1 GENERAL REQUIREMENTS
- 3.2 QUALITY CONTROL PLAN
 - 3.2.1 Content of the CQC Plan
 - 3.2.2 Acceptance of Plan
 - 3.2.3 Notification of Changes
- 3.3 COORDINATION MEETING
- 3.4 QUALITY CONTROL ORGANIZATION
 - 3.4.1 Personnel Requirements
 - 3.4.2 CQC System Manager
 - 3.4.3 CQC Personnel
 - 3.4.4 Additional Requirement
 - 3.4.5 Organizational Changes
- 3.5 SUBMITTALS AND DELIVERABLES
- 3.6 CONTROL
 - 3.6.1 Preparatory Phase
 - 3.6.2 Initial Phase
 - 3.6.3 Follow-up Phase
 - 3.6.4 Additional Preparatory and Initial Phases
- 3.7 TESTS
 - 3.7.1 Testing Procedure
 - 3.7.2 Testing Laboratories
 - 3.7.2.1 Capability Check
 - 3.7.2.2 Capability Recheck
 - 3.7.3 Onsite Laboratory
- 3.8 COMPLETION INSPECTION
 - 3.8.1 Punch-Out Inspection
 - 3.8.2 Pre-Final Inspection
 - 3.8.3 Final Acceptance Inspection
- 3.9 DOCUMENTATION
- 3.10 SAMPLE FORMS
- 3.11 NOTIFICATION OF NONCOMPLIANCE

-- End of Section Table of Contents --

SECTION 01451

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(1996) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
-------------	---

ASTM E 329	(1995b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
------------	---

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with quality requirements specified in the contract. The project superintendent in this context shall mean the individual with the responsibility for the overall management of the project including quality and production.

3.2 QUALITY CONTROL PLAN

The Contractor shall furnish for review by the Government, not later than 14 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 14 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.1 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01330 SUBMITTAL PROCEDURES.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)
- f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests

including documentation.

- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.
- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

3.2.2 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.3 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 14 calendar days prior to the Coordination Meeting.

During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure contract compliance. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer.

3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be [a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of 5 years construction experience on construction similar to this contract. This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: civil, structural, and environmental,. These individuals shall be directly employed by the prime Contractor and may not be employed by a supplier or sub-contractor on this project; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals shall have no other duties other than quality control.

Experience Matrix

Area		Qualifications
a.	Civil	Graduate Civil Engineer with 2 years experience in the type of work being performed on this project or technician with 5 yrs related experience
b.	Structural	Graduate Structural Engineer with 2 yrs experience or person with 5 yrs related experience

Experience Matrix

	Area	Qualifications
c.	Environmental	Graduate Environmental Engineer with 3 yrs experience

3.4.4 Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management For Contractors".

3.4.5 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals and deliverables are in compliance with the contract requirements.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

- a. A review of each paragraph of applicable specifications, reference codes, and standards. A copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field shall be made available by the Contractor at the preparatory inspection. These copies shall be maintained in the field and available for use by Government personnel until final acceptance of the work.
- b. A review of the contract drawings.

- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
- f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- g. A review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. Discussion of the initial control phase.
- k. The Government shall be notified at least 48 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.

- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government shall be notified at least 48 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
- g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.

- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the Special Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications, the CQC Manager shall conduct an inspection of the work. A punch list of items which do not conform to the approved drawings and specifications shall be prepared and included in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the

deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected.

Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of

work performed each day by NAS activity number.

- d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase shall be identified (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.
- g. Offsite surveillance activities, including actions taken.
- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- i. Instructions given/received and conflicts in plans and/or specifications.
- j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 48 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

3.10 SAMPLE FORMS

Sample forms enclosed at the end of this section.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has

been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

PART 1 GENERAL

- 1.1 GENERAL REQUIREMENTS
 - 1.1.1 Identification of Employees
- 1.2 AVAILABILITY AND USE OF UTILITY SERVICES
 - 1.2.1 Payment for Utility Services
 - 1.2.2 Sanitation
 - 1.2.3 Telephone
- 1.3 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN
 - 1.3.1 Project and Safety Signs
- 1.4 PROTECTION AND MAINTENANCE OF TRAFFIC
 - 1.4.1 Barricades
- 1.5 CONTRACTOR'S TEMPORARY FACILITIES
 - 1.5.1 Administrative Field Offices
 - 1.5.2 Storage Area
 - 1.5.3 Supplemental Storage Area
 - 1.5.4 Appearance of Trailers
 - 1.5.5 Maintenance of Storage Area
- 1.6 TEMPORARY PROJECT SAFETY FENCING
- 1.7 CLEANUP
- 1.8 RESTORATION OF STORAGE AREA

-- End of Section Table of Contents --

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Identification of Employees

The Contractor shall be responsible for furnishing to each employee, and for requiring each employee engaged on the work to display, identification as approved and directed by the Contracting Officer. Prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of any employee. When required, the Contractor shall obtain and provide fingerprints of persons employed on the project. Contractor and subcontractor personnel shall wear identifying markings on hard hats clearly identifying the company for whom the employee works.

1.2 AVAILABILITY AND USE OF UTILITY SERVICES

1.2.1 Payment for Utility Services

The Government will make all reasonably required utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

1.2.2 Sanitation

The Contractor shall provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

1.2.3 Telephone

The Contractor shall make arrangements and pay all costs for telephone facilities desired.

1.3 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.3.1 Project and Safety Signs

The requirements for the signs, their content, and location shall be as shown on the drawings. The signs shall be erected within 15 days after receipt of the notice to proceed. The data required by the safety sign shall be corrected daily, with light colored metallic or non-metallic numerals. Upon completion of the project, the signs shall be removed from the site.

1.4 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic. The Contractor shall maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

1.4.1 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

1.5 CONTRACTOR'S TEMPORARY FACILITIES

1.5.1 Administrative Field Offices

If the Contractor wants an administrative field office facilities within the construction area at the designated site he shall provide for it and coordinate the location with Contracting Officer.

1.5.2 Storage Area

The Contractor shall construct a temporary 6 foot high chain link fence around trailers and materials. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day.

1.5.3 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the military boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

1.5.4 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on the military property.

1.5.5 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

1.6 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and erect temporary project safety fencing at the work site. The safety fencing shall be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site. An existing fence that the Contractor shall use is located along the front and south side of the site. Contractor shall provide a temporary fence at the gate openings. The back side of the site is secure due to it being located at an airfield area.

1.7 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away.

1.8 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01505

GENERAL REQUIREMENTS

PART 1 GENERAL

- 1.1 SCRAP MATERIAL
- 1.2 WRITTEN GUARANTEES AND GUARANTOR'S LOCAL REPRESENTATIVE
- 1.3 PRICING OF CONTRACTOR-FURNISHED PROPERTY
- 1.4 TEMPORARY ELECTRIC WIRING
 - 1.4.1 Temporary Power and Lighting
 - 1.4.2 Construction Equipment
 - 1.4.3 Circuit Protection
- 1.5 UTILITIES
- 1.6 GENERAL SAFETY REQUIREMENTS
 - 1.6.1 General
 - 1.6.2 The Prime Contractor's Superintendent
 - 1.6.3 Job Hazard Analysis
 - 1.6.3.1 Explosive Ordnance
 - 1.6.4 Violations
 - 1.6.5 Elevated Work Areas
 - 1.6.5.1 Protection
 - 1.6.5.2 Guard Rails
 - 1.6.6 Fire Prevention
 - 1.6.6.1 Inspections
 - 1.6.7 Recordkeeping/Reporting Requirements
 - 1.6.8 Accident Reporting
- 1.7 PLANNED UTILITY OUTAGES AND STREET CLOSURES
- 1.8 EXCAVATION PERMITS
- 1.9 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER
- 1.10 EQUIPMENT DATA FORM
- 1.11 HAUL ROUTE PLAN
- 1.12 AIRFIELD FOREIGN OBJECT DAMAGE (FOD)
- 1.13 CONTRACTOR SAFETY PERSONNEL REQUIREMENTS (1985 JAN HQ USACE)
- 1.14 MONTHLY SAFETY INSPECTION
- 1.15 AREAS OF RADAR RADIATION HAZARD
- 1.16 HAZARDOUS NOISE AREA
- 1.17 AGGREGATE SOURCES
- 1.18 COLOR SCHEME FOR CONTRACTOR FACILITIES
- 1.19 ONE YEAR MAINTENANCE CONTRACT
- 1.20 UNITED STATES NOT A PARTY
- 1.21 WARRANTY OF CONSTRUCTION
- 1.22 INSPECTION
- 1.23 FINAL EXAMINATION AND ACCEPTANCE
- 1.24 Special Construction Procedures

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section Table of Contents --

SECTION 01505

GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SCRAP MATERIAL

Materials specified to be removed and become the property of the Contractor are designated as scrap, and the Contractor, by signing this contract, hereby acknowledges that he has made due allowance for value, if any, of such scrap in the contract price.

1.2 WRITTEN GUARANTEES AND GUARANTOR'S LOCAL REPRESENTATIVE

Prior to completion of the contract, the Contractor shall obtain and furnish to the Contracting Officer's representative written guarantees for all the equipment and/or appliances furnished under the contract. The Contractor shall furnish with each guarantee: The name, address, and telephone number of the guarantor's representative nearest to the location where the equipment and/or appliances are installed, who, upon request of the Using Service's representative, will honor the guarantee during the guaranty period and will provide the services prescribed by the terms of the guarantee.

1.3 PRICING OF CONTRACTOR-FURNISHED PROPERTY

At the request of the Contracting Officer, the Contractor shall promptly furnish and shall cause any subcontractors to furnish, in like manner, unit prices and descriptive data required by the Government for property record purposes of fixtures and equipment furnished and installed by the Contractor.

1.4 TEMPORARY ELECTRIC WIRING

1.4.1 Temporary Power and Lighting

The Contractor shall provide construction power facilities in accordance with the safety requirements of the National Electrical Code NFPA No. 70 and the SAFETY AND HEALTH REQUIREMENTS MANUAL EM 385-1-1. The Contractor, or his delegated subcontractor, shall enforce all the safety requirements of electrical extensions for the work of all subcontractors. All work shall be accomplished by skilled electrical tradesmen in a workmanlike manner, as approved by the Contracting Officer.

1.4.2 Construction Equipment

In addition to the requirements of EM 385-1-1, SAFETY AND HEALTH

REQUIREMENTS MANUAL, all temporary wiring conductors installed for operation of construction tools and equipment shall be either Type TW or THW contained in metal raceways, or may be multiconductor cord. Temporary wiring shall be secured above the ground or floor in a workmanlike manner and shall not present an obstacle to persons or equipment. Open wiring may only be used outside of buildings, and then only in strict accordance with the provisions of the National Electrical Code.

1.4.3 Circuit Protection

In addition to the present requirements in EM 385-1-1 and the National Electrical Code, all 15 and 20-ampere receptacle outlets used for obtaining power during construction shall have ground fault circuit interrupters (GFCI) for personnel protection. Block and brick saws shall also be equipped with GFCI. The Contracting Officer may allow an exception to this requirement for circuits for concrete vibrators or circuits operating at other than 60 Hertz normal (in both cases an assured grounding program as described in the National Electrical Code, except utilizing the daily inspection frequency of the grounding means of such equipment, may be permitted). The assured grounding program will not be permitted as a substitute for usage of GFCI'S except as described above. All generator-powered 15- and 20-ampere, 60 Hertz receptacle outlets shall have GFCI'S, and shall be properly grounded. A testing means shall be provided which will impose a measured fault of 5 milliamperes, plus or minus 1 milliamperes, and result in tripping the GFCI unit.

1.5 UTILITIES

If the Contractor encounters, within the construction limits of the entire project, utilities not shown on the plans and not visible as to the date of this contract and such utilities will interfere with construction operations, he shall immediately notify the Contracting Officer in writing to enable a determination by the Contracting Officer as to the necessity for removal or relocation. If such utilities are removed or relocated as directed by the Contracting Officer, the Contractor shall be entitled to equitable adjustment for any additional pertinent work or delay.

1.6 GENERAL SAFETY REQUIREMENTS

1.6.1 General

The Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, (see Contract Clauses, Section 00700, ACCIDENT PREVENTION) and the Occupational Safety and Health Act (OSHA) Standards for Construction (Title 29, Code of Federal Regulations Part 1926 as revised from time to time); General Industry Standards (Title 29, Code of Federal Regulations Part 1910 as revised from time to time); and the National Fire Protection Association Codes are applicable to this contract. In case of conflict the most stringent requirement of the standards is applicable.

1.6.2 The Prime Contractor's Superintendent

The Prime Contractor's superintendent shall take an active role in enforcing the safety requirements by participation in safety conferences, hazard analysis (see below), tool box meetings, walk-through inspections, correction of violations, etc., and including that of the subcontractor's work.

1.6.3 Job Hazard Analysis

Based on the construction schedule, the Contractor shall submit a job hazard analysis of each major phase of work prior to entering that phase of activity. The analysis shall include major or high risk hazards, as well as commonly recurring deficiencies that might possibly be encountered for that operation, and shall identify proposed methods and techniques of accomplishing each phase in a safe manner. The Prime Contractor's superintendent shall take active participation in the Job Hazard Analysis, including the subcontractors' work. Prior to start of actual work a meeting shall be held with Prime Contractor, Government, and affected subcontractor to review the Job Hazard Analysis. In addition, job site meetings shall be held to indoctrinate foreman and workers on details of this analysis.

1.6.3.1 Explosive Ordnance

1.6.4 Violations

If recurring violations and/or gross violation indicate that the safety performance is unsatisfactory, corrective action shall be taken as directed, and at the discretion of the Contracting Officer the retention or some part thereof will be withheld from the progress payment until corrective action has been completed.

1.6.5 Elevated Work Areas

Workers in elevated work areas in excess of 6 feet above an adjoining surface require special safety attention. In addition to the provisions of EM 385-1-1, the following safety measures are required to be submitted to the Contracting Officer's Representative. Prior to commencement of work in elevated work areas, the Contractor shall submit drawings depicting all provisions of his positive protection system including, but not limited to, all details of guard rails.

1.6.5.1 Protection

Positive protection for workmen engaged in the installation of structural steel and steel joists shall be provided by safety nets, tie-off's, hydraulic man lifts, scaffolds, or other required means. Decking crews must be tied-off or work over nets or platforms not over 6 feet below the work area. Walking on beams and/or girders and the climbing of columns is prohibited without positive protection.

1.6.5.2 Guard Rails

Perimeter guard rails shall be installed at floor, roof, or wall openings

more than 6 feet above an adjoining surface and on roof perimeters. Rails shall be designed to protect all phases of elevated work including, but not limited to, roofing operations and installation of gutters and flashing. Rails around roofs may not be removed until all work on the roof is complete and all traffic on or across the roof ceases. Rails shall be designed by a licensed engineer to provide adequate stability under any anticipated impact loading. As a minimum, the rails shall consist of a top rail at a height of 42 inches, a mid rail and a toe board. Use of tie-offs, hydraulic man lifts, scaffolds, or other means of roof edge protection methods may be utilized on small structures such as family housing, prefabricated metal buildings, etc.

1.6.6 Fire Prevention

Twenty-four hours notice shall be given to the Contracting Officer for coordination with the Facility Fire Department prior to conducting any fire hazardous operation. Cutting or welding will be permitted only in areas that are or have been made fire safe. Where possible, all combustibles shall be located at least 35 feet horizontally from the work site. Where such location is impracticable, combustibles shall be protected with fire blankets and/or protective welding screens to prevent slag from running out of the work area. Edges of covers at the floor shall be tight to prevent sparks from going under them. This precaution is also important at overlaps where several covers are used to protect a large pile. The Contractor shall not allow any welding/cutting or open flame operations in facilities that are protected by a wet pipe fire sprinkler or an automatic detection system, if the system is out of service. First priority of work will be to return the suppression/detection system to operational condition. Return the fire detection and/or suppression system back to an operational status (if possible) during periods that the facility is unoccupied, and at the end of the work day. The Contractor shall post a fire guard for a 24 hour period (or certify to the Fire Department that the facility is safe) after welding, cutting, and open flame operations in a facility when: (a) fire detection and suppression system can not be returned to service; (b) fire detection or suppression systems do not exist. Other fire prevention precautions shall be in accordance with the latest National Fire Codes.

1.6.6.1 Inspections

All construction sites are subject to fire and safety inspections without notice. Any violation of fire and safety standards may result in a work stoppage at the expense of the Contractor.

1.6.7 Recordkeeping/Reporting Requirements

On all contract operations, the Prime Contractor shall be responsible for recording and reporting all accident exposure and experience incident work. (This includes exposure and experience of the prime contractor and his/her sub-contractor(s)). As a minimum these records shall include exposure work-hours and a log of occupational injuries and illnesses. (OSHA Form 200 or state equivalent as prescribed by 29 CFR 1904.5) Reference EM 385-1-1, 01.D.04.

1.6.8 Accident Reporting

In addition to the requirements for reporting accidents in accordance with EM 385-1-1, Section 1, the Prime Contractor will submit at the 50% point and 100% of project completion, a written summary of worker's compensation claims filed by workers on the project. The report will include all subcontractors. The main report covering the Prime Contractor claims will be certified as "correct and true" by the Contractor's compensation insurance carrier. The same certification will be required for subcontractor reports.

1.7 PLANNED UTILITY OUTAGES AND STREET CLOSURES

All utility outages and street closures shall be of as short a duration as possible and shall be scheduled as far in advance as possible with the Contracting Officer, in no case less than 14 days before the outage or closure. The Contractor shall obtain in writing from the Contracting Officer a statement or schedule giving the permissible times of outages or closures for particular installations and the maximum time allowed for each. The Contractor shall strictly observe such schedules and will be held responsible for any violations.

(A) Street Closure:

The Contractor shall obtain approval in writing from the Contracting Officer before he can close any street or parking lot access. The request for closure shall be submitted in writing to the Contracting Officer 7 working days prior to planned closing and shall include the section to be closed and length of time of closure.

Power outages shall be restricted to off-duty hours and weekends. Other utilities may be connected and streets closed during normal working hours with the outage duration and street closure as short as possible. All outages and street closures shall be scheduled as far in advance as possible with the Contracting Officer and in no case less than **14** days before the outage or closure. The Contractor shall obtain in writing from the Contracting Officer a statement or schedule giving the permissible times of utility outages or road closures for particular installations and the maximum time allowed for such outage. The Contractor shall strictly observe such schedules and will be held responsible for any violations.

(A) Street Closure:

The Contractor shall obtain approval in writing from the Contracting Officer before he can close any street or parking lot access. The request for closure shall be submitted in writing to the Contracting Officer 7 working days prior to planned closing and shall include the section to be closed and length of time of closure.

Utility outages and street closures shall be restricted to off-duty hours and weekends, with the outage duration and street closure as short as possible. All outages and street closures shall be scheduled as far in advance as possible with the Contracting Officer and in no case less than

14 days before the outage or closure. The Contractor shall obtain in writing from the Contracting Officer a statement or schedule giving the permissible times of utility outages or road closures for particular installations and the maximum time allowed for such outage. The Contractor shall strictly observe such schedules and will be held responsible for any violations.

All utility outages and street closures shall be of as short a duration as possible and shall be scheduled as far in advance as possible with the Contracting Officer, in no case less than 14 days before the outage or closure. The Contractor shall obtain in writing from the Contracting Officer a statement or schedule giving the permissible times of outages or closures for particular installations and the maximum time allowed for each. The Contractor shall strictly observe such schedules and will be held responsible for any violations. Before any outage or closure is scheduled, the Contractor will: 1) Have all approved materials necessary for the outage on hand, 2) Have completed, tested and been inspected by the Construction Quality Control Representative all preliminary work, 3) Prepare an accepted hazard analysis in accordance with section "ACCIDENT PREVENTION", 4) Have all permits and personnel qualifications on hand, 5) Have held a joint inspection with a representative of the Contracting Officer and the Construction Quality Control Representative.

1.8 EXCAVATION PERMITS

All excavation permits will be issued to the Contractor from the Base Civil Engineer (BCE) through the Contracting Officer. The appropriate form, for this request, may be obtained from the Contracting Officer. Processing time required by the BCE is 14 calendar days. Questions concerning the excavation permit should be directed to the Contracting Officer.

1.9 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

(A) This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the CONTRACT CLAUSE, Section 00700, entitled "DEFAULT (FIXED-PRICE CONSTRUCTION)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

(1) The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

(2) The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

(B) The following schedule of monthly anticipated adverse weather

delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
WORK DAYS BASED ON (5) DAY WORK WEEK

BEALE AFB/MARYSVILLE

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
(07)	(06)	(05)	(04)	(01)	(00)	(00)	(00)	(01)	(02)	(05)	(07)

(C) Upon acknowledgement of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day.

(ER 415-1-15, 31 OCT 89)

1.10 EQUIPMENT DATA FORM

In conjunction with paragraph, EFARS 52.231-5000 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE, in Section 00800, the Contractor shall furnish SPK Form 450 for all necessary equipment to perform work requiring adjustment of contract price and shall submit these forms with the modification proposals. A sample form is at the end of this section.

1.11 HAUL ROUTE PLAN

This plan shall include offices, material storage areas and structures and the access routes to these areas. Haul routes from the sites through the military reservations to major highways shall be indicated. All required traffic signs, special limits, warning devices, lighting and other such safety devices required by EM 385-1-1, OSHA, local cities and Cal Trans (on state roads) shall be shown. Provisions shall be made in the plan for alternate routes when excavations block designated haul routes. The plan shall be revised and resubmitted if the haul routes being used are not as shown on the plan.

(A) Coordination with Technical Specifications:

Work for sections such as Demolition, Grading, Tree Removal and other sections with excavations shall be coordinated with this plan.

(B) Protection of Land Resources:

This Haul Plan shall include the requirements of SECTION:
ENVIRONMENT PROTECTION especially paragraph, PROTECTION OF LAND RESOURCES
and all the clauses referenced therein.

1.12 AIRFIELD FOREIGN OBJECT DAMAGE (FOD)

(A) Clean up:

Contractor shall be responsible for the cleanliness of his work areas at all times during his contract performance. This shall include but not be limited to immediate clean-up of any material that may spread onto aircraft taxiways, aprons, ramps and pads. Contractor shall provide a pavement vacuum/sweeper at the project site at all times during his performance. Every time any haul vehicles cross the taxiways, aprons, ramps and pads, the area shall be cleaned by the pavement vacuum/sweeper immediately. The Contractor shall be responsible for repair or replacement of any foreign object damages to the aircrafts or components of the aircrafts resulting from his negligence.

1.13 CONTRACTOR SAFETY PERSONNEL REQUIREMENTS (1985 JAN HQ USACE)

(A) Full-time, on-site, safety coverage by contractors shall be required for the life of the contract.

(B) The following conditions shall be met:

(1) The Contractor shall employ, to cover all hours of work at the project site(s), at least one safety and health person to manage the Contractor's safety program; duties which are not germane to the safety program shall not be assigned to this person(s). The principal safety and health person shall report to and work directly for the Contractor's top on-site manager, corporate safety office, or other high-level official of equivalent position. The safety and health person(s) shall have the authority to take immediate steps to correct unsafe or unhealthful conditions. The employment of a safety and health person(s) shall not abrogate the safety and health responsibilities of other personnel.

(2) Qualifications for Safety and Health Person(s).

(a) Safety and Health Person(s) shall have a degree in engineering or safety in at least a four year program from an accredited school and shall have been engaged in safety and occupational health for at least one (1) year of experience (no time being credited to this one (1) year unless at least fifty (50) percent of the time was devoted to safety and occupational health) and shall have at least one (1) year experience in construction, or--

(b) Safety and Health Person(s) shall have legal registration as a Professional Engineer or a Certified Safety Professional and shall have been engaged in safety and occupational health for at least one (1) year of experience (no time being credited to this one (1) year unless at least fifty (50) percent of the time was devoted to safety and occupational health) and shall have at least one (1) year experience in construction, or--

(c) Safety and Health Person(s) shall have a degree other than that specified in paragraph, Qualifications for Safety and Health Person(s) above, and shall have been engaged in safety and occupational health for at least three (3) years of experience (no time being credited to these three (3) years unless at least fifty (50) percent of the time each year was devoted to safety and occupational health) and shall have at least two (2) years experience in construction, or--

(d) In lieu of a degree, Safety and Health person(s) shall have been engaged in safety and occupational health for at least five (5) years of experience (no time being credited to these five (5) years unless at least fifty (50) percent of the time each year was devoted to safety and occupational health) and shall have at least two (2) years experience in construction.

(e) First aid work is not a creditable experience.

(3) The name and qualifications of the nominated safety and health person(s) shall be furnished to the Contracting Officer for acceptability and a functional description of duties shall be provided prior to the pre-work conference.

NOTE: The Contractor shall have one or more Safety and Health Persons, each of whom meets the qualifications of (B)(2) Qualifications for Safety and Health Person(s), physically present on the actual site of the work whenever work of any sort is being performed by a Contractor, subcontractor, or supplier personnel on the work site. The foregoing clause language shall not be interpreted to contravene this note.

1.14 MONTHLY SAFETY INSPECTION

A monthly on-site inspection will be made by the insurance carriers of the prime and subcontractors. The Contractor's safety program will be reviewed and a meeting will be held with the Contracting Officer's Representative to discuss the job-site safety. A written report will be made by the Contractor stating the results of the inspection and the action taken.

1.15 AREAS OF RADAR RADIATION HAZARD

The work under this contract is to be performed in, or in the vicinity of, areas that may be hazardous at times due to radar radiation. Construction activities and Contractor's personnel shall not be allowed within such areas without prior arrangement with and the approval of the Contracting Officer. The Contractor shall maintain a close working relationship with the Contracting Officer's representative and shall govern his activities within such areas as said representative may arrange with operating personnel of the Air Force.

1.16 HAZARDOUS NOISE AREA

Work area for this contract is located within a high noise area and can be hazardous to the human ear. The Contractor is responsible for providing adequate ear protection as may be required for Contractor's personnel at the job site.

1.17 AGGREGATE SOURCES

(A) Concrete aggregates may be produced from the approved sources listed below:

(1) Sources of fine aggregate. (List the sources in an appropriate manner.)

(2) Sources of coarse aggregate. (List the sources in an appropriate manner.)

(B) Concrete aggregates may be furnished from any of the above listed sources or at the option of the Contractor may be furnished from any other source designated by the Contractor and approved by the Contracting Officer, subject to the conditions hereinafter stated.

(C) After the award of the contract, the Contractor shall designate in writing, only one source or one combination of sources from which he proposes to furnish aggregates. If the Contractor proposes to furnish aggregates from a source or from sources not listed above, he may designate only a single source or a single combination of sources for aggregates. Samples for acceptance testing shall be provided as required by Section:

of the Technical Specifications. If a source for coarse or fine aggregate so designated by the Contractor is not approved for use by the Contracting Officer, the Contractor may not submit for approval other sources but shall furnish the coarse or fine aggregate, as the case may be, from a listed source listed above at no additional cost to the Government.

(D) Listing of a concrete aggregate source is not to be construed as approval of all material from that source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels, when such materials are unsuitable for concrete aggregate as determined by the Contracting Officer. Materials produced from a listed source shall meet all the requirements of Section: of the Technical Specifications of these specifications.

1.18 COLOR SCHEME FOR CONTRACTOR FACILITIES

(A) All Contractor storage and operational facilities including temporary structures, signs and fencing, that remain at the site shall be compatible with the color scheme used on the project signs as directed by the Contracting Officer.

1.19 ONE YEAR MAINTENANCE CONTRACT

(A) The equipment manufacturer or his authorized representative shall provide all equipment, materials and labor to maintain all portions of the equipment listed below for one year after the complete system is placed in operation, responding effectively to calls from the Using Service within 24 hours.

(B) In lieu of such a maintenance contract, provide a complete set of replacement parts and equipment that will allow any replaceable element, part or component of the system to be replaced. Further, technically qualified staff of the equipment manufacturer shall be available by telephone, during all normal factory working hours to advise previously trained, Using Service personnel on what steps should be taken to correct the problem related.

1.20 UNITED STATES NOT A PARTY

(A) No appropriated funds exist for the construction which is the subject of this IFB. Article 1, Section 9, Clause 7, of the U.S. Constitution states: "No money shall be drawn from the Treasury, but in Consequence of Appropriations made by Law". 41 USC 11 states: No contract --- on behalf of the United States shall be made, unless the same is authorized by law or under an appropriation adequate to its fulfillment--". 41 USC 12 states: "No contract shall be entered into for the erection, repair, or furnishing of any public building -- which shall bind the Government to pay a larger sum of money than the amount in the Treasury appropriated for the specific purpose."

(B) Since no funds have been appropriated for the construction, it would be illegal for the United States of America to enter into a contract for the construction.

(C) A sum of money has been placed in an account (the fund) for the contract. The fund will be the party with which the successful bidder enters into a contract.

(D) In the event funds are insufficient to complete the project the Contractor will have no obligation to continue work on the project. This is the only exception to the last sentence of the disputes clause.

(E) It is foreseeable that funds in addition to those in the account may not be available. It will be the responsibility of the Contractor to manage his affairs so that he does not require in excess of those available (see d. above).

(F) Where there is any indication in this IFB, or the resulting contract, that the United States is a party to this construction, it shall nevertheless be understood that it is merely the fund, and not the United States, which is the party indicated.

1.21 WARRANTY OF CONSTRUCTION

(a). Performance Bond.

(1). It is understood that the Contractor's Performance Bond will remain effective throughout the life of all warranties and warranty extensions.

(2). In the event the Contractor or his designated representative fails to commence and diligently pursue any work required under the Warranty of Construction Section of the Technical Provisions within a reasonable time after receipt of written notification pursuant to the requirements thereof, the Contracting Officer shall have a right to demand

that said work be performed under the Performance Bond by making written notice on the surety. If the surety fails or refuses to perform the obligation it assumed under the Performance Bond, the Contracting Officer shall have the work performed by others, and after completion of the work, shall make demand for reimbursement of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

(3). Warranty repair work which arises to threaten the health or safety of personnel, the physical safety of property or equipment, or which impairs operations, habitability of living spaces, etc., will be handled by the Contractor on an immediate basis as directed verbally by the Contracting Officer or his authorized representative. Written verification will follow verbal instructions. Failure of the Contractor to respond as verbally directed will be cause for the Contracting Officer or his authorized representative to have the warranty repair work performed by others and to proceed against the Contractor as outlined in the paragraph b. above.

(b). Pre-Warranty Conference. Prior to contract completion and at a time designated by the Contracting Officer or his authorized representative, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of SECTION 00700, Paragraph, WARRANTY OF CONSTRUCTION, of this specification. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer or his authorized representative for the execution of the construction warranty shall be established/reviewed at this meeting.

In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This single point of contact will be located within the local service area of the warranted construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of his responsibilities in connection with Section 00700, Paragraph, WARRANTY OF CONSTRUCTION.

(c). Equipment Warranty Identification Tags. The Contractor shall provide warranty identification tags on all equipment installed under this contract.

(d). Contractor's Response to Warranty Service Requirements. The following warranty service requirements are applicable to this contract. Following notification by the Contracting Officer or the Contracting Officer's Representative the Contractor shall respond to a warranty service requirement identified by the Contracting Officer's Representative in accordance with the "Warranty Service Priority List" of this program. This list prioritizes warranty work into the categories:

First Priority 1A Perform on site inspection to evaluate situation,

determine course of action, initiate work within 24 hours and work continuously to completion or relief.

Second Priority 1B Perform on site inspection to evaluate situation, determine course of action, initiate work within 48 hours and work continuously to completion of relief.

Third Priority All other work to be initiated within 5 work days and work continuously to completion or relief.

The "Warranty Service Priority List" shall be compiled by the Contractor and approved by the Contracting Officer.

Should parts be required to complete the work and the parts are not immediately available the Contractor shall have a maximum of 12 hours after arrival at the job site to provide the Contracting Officer's Representative with firm written proposals for emergency alternatives and temporary repairs for Government participation with the Contractor to provide emergency relief until the required parts are available on site for the Contractor to perform permanent warranty repair. The Contractor's proposals shall include a firm date and time that the required parts shall be available on site to complete the permanent warranty repair. The Contracting Officer's Representative will evaluate the proposed alternatives and negotiate the alternative considered to be in the best interest of the Government to reduce the impact of the emergency condition.

Alternatives considered by the Contracting Officer's Representative will include the alternative for the Contractor to "Do Nothing" while waiting until the required parts are available to perform permanent warranty repair. Negotiating a proposal which will require Government participation and the expenditure of Government funds shall constitute a separate procurement action by the using service.

1.22 INSPECTION

The inspectors will direct the maintenance of the gauges, ranges, location marks and limit marks in proper order and position; but the presence of the inspector shall not relieve the Contractor of responsibility for the proper execution of the work in accordance with the specifications. The Contractor will be required:

(A) To furnish, on the request of the Contracting Officer or any inspector, the use of such boats, boatmen, laborers, and material forming a part of the ordinary and usual equipment and crew of the dredging plant as may be reasonably necessary in inspecting and supervising the work. However, the Contractor will not be required to furnish such facilities for the survey, prescribed in the clause entitled "Final Examination and Acceptance".

(B) To furnish, on the request of the Contracting Officer or any inspector, suitable transportation from all points on shore designated by the Contracting Officer to and from the various pieces of plant, and to and from the dumping grounds.

Should the Contractor refuse, neglect, or delay compliance with these requirements, the specific facilities may be furnished and maintained by the Contracting Officer, and the cost thereof will be deducted from any amounts due or to become due the Contractor.

1.23 FINAL EXAMINATION AND ACCEPTANCE

(A) As soon as practicable after the completion of the entire work or any section thereof (if the work is divided into sections) as in the opinion of the Contracting Officer will not be subject to damage by further operations under the contract, such work will be thoroughly examined at the cost and expense of the Government by sounding or by sweeping, or both, as determined by the Contracting Officer. Should any shoals, lumps, or other lack of contract depth be disclosed by this examination the Contractor will be required to remove same by dragging the bottom or by dredging at the contract rate for dredging, but if the bottom is soft and the shoal areas are small and form no material obstruction to navigation, the removal of such shoal may be waived by the discretion of the Contracting Officer. The Contractor or his authorized representative will be notified when soundings and/or sweepings are to be made, and will be permitted to accompany the survey party. When the area is found to be in a satisfactory condition, it will be accepted finally. Should more than two sounding or sweeping operations by the Government over an area be necessary by reason of work for the removal of shoals disclosed at a prior sounding or sweeping, the cost of such third and any subsequent sounding or sweeping operations will be charged against the Contractor at the rate of \$1,000.00 per day for each day in which the Government plant is engaged in sounding or sweeping and/or is enroute to or from the site or held at or near the said site for such operations.

(B) Final acceptance of the whole or a part of the work and the deductions or corrections of deductions made thereon will not be reopened after having once been made, except on evidence of collusion, fraud, or obvious error, and the acceptance of a completed section shall not change the time of payment of the retained percentages of the whole or any part of the work.

1.24 Special Construction Procedures

Contractor shall obtain temporary passes from the Government for all of their personnel

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

SECTION 01510

WORK SEQUENCE AND GOVERNMENT-FURNISHED ITEMS

TABLE OF CONTENTS

	<u>Page</u>
1.1 GOVERNMENT-FURNISHED CONTRACTOR INSTALLED ITEMS (G.F.C.I.)	1
1.2 PROVISIONS FOR FUTURE WORK	1
1.3 WORK SEQUENCE	1
1.4 CONTRACTOR'S USE OF SITE AND BEALE AFB CONTINUED OPERATION OF THE WATER SYSTEM	2

SECTION 01510

WORK SEQUENCE AND GOVERNMENT-FURNISHED ITEMS

1.1 GOVERNMENT-FURNISHED CONTRACTOR INSTALLED ITEMS (G.F.C.I.)

- A. Certain items required for this project will be furnished by the Government and installed by the Contractor. Such items are referred to as "Government-Furnished Contractor Installed (G.F.C.I.)." G.F.C.I. items shall be relocated and/or picked up by the Contractor at the locations shown on the drawings, transported to the project site and installed by the Contractor.
- B. Contractor's installation of G.F.C.I. items shall include attaching or anchoring items, connecting utilities and controls, lubricating and necessary adjustment, startup, testing, and placing items in service.
- C. Coordinate the installation of all Government furnished items with Beale AFB and the Contracting Officer.

Government furnished items include:

- 600 feet of 18-inch PVC C905 pipe
- (1) 3,000 Gallon Hypochlorite Storage Tank with Seismic Restraint
- (1) Rectifier with PLC Controller
- (1) MC Rack
- (1) Chemical Metering Pump with VFD
- (1) Dual Water Softener
- (2) Cuno filters
- (1) Mounting Board with Chlorine, Fluoride and pH Analyzers

1.2 PROVISIONS FOR FUTURE WORK

Beale AFB intends to build additional facilities as shown on the site plan. The Contractor shall not locate or support any conduits, pipes, ductwork, equipment or other items in such a way that they will have to be relocated or resupported when the future improvements are constructed.

1.3 WORK SEQUENCE

- A. Construct work in sequence to accommodate Beale AFB's continued use and operation of existing water system. Coordinate construction schedule with Contracting Officer.
- B. The following general sequence of operations is suggested:
 - 1. Construct new water treatment plant and modify power distribution system as shown on the Drawings except the following work:
 - Well Water/Filtered Water tie-ins
 - Sewer tie-in

Note: Housing pipeline can be constructed concurrently with new water treatment plant including all tie-ins.
 - 2. Provide and install temporary chlorine and fluoride tank/feed system at existing water treatment plant (Building 701 Area).

A. Beale AFB will operate the temporary system. Contractor Is required to provide the following:

- 1) Chemicals for the temporary system.
 - Sodium Hypochlorite (Chlorine) at 12.5% solution
(Maximum dosing rate: 120 gallons/day)
 - Hydrofluosilicic Acid (Fluoride) at 23% solution
(Maximum dosing rate: 22 gallons/day)
- 2) Training for Beale AFB for operating the temporary system.
- 3) Maintenance for the temporary system equipment.
3. Relocate existing sodium hypochlorite generation system to Operations Building at new water treatment plant.
4. Clean and clear Building 701.
5. Install new conduit and pull box at existing water treatment plant. Relocate existing well RTU to Building 701.
6. Demolish Building 700.
7. Construct well water/filtered water piping connections to existing 18-inch PVC C905 pipe.
8. Tap chemical diffusers into existing 18-inch PVC C905 pipe.
9. Relocate existing chlorine analyzer, fluoride analyzer and pH analyzer from Building 540.
10. Construct manhole to existing 12-inch sewer line.
11. Construct backwash water supply connection to existing 18-inch PVC 905 at 34th and C Street.
12. Place new water treatment plant in operation.
13. Remove temporary chlorine and fluoride equipment from Building 701 following successful start-up of treatment plant.

C. The following individual work shall be accomplished during shutdowns that are no longer than 8-hours in duration:

- Well Water/Filtered Water tie-in
- 34th and C Street tie-in
- 18" Diameter Housing Pipeline tie-in
- Child Care Center & Gavin Mandery Drive tie-in
- Sewer tie-in

1.4 CONTRACTOR'S USE OF SITE AND BEALE AFB CONTINUED OPERATION OF THE WATER SYSTEM

- A. The Contractor shall confine his use of the site for work and storage to the Work Area Limits shown on the contract drawings. The Contractor's use of adjacent lands and roads for access to move onto and off of the site and for daily access of workers, material and equipment shall be arranged and scheduled to minimize interference with the Beale AFB continued operation of the water system.
- B. Beale AFB will continue operation of its existing water system during all of the construction period. The Contractor shall plan and schedule its work to minimize impacting the Beale AFB's continued operations and shall, at all times, maintain safe access for the Beale AFB's operating personnel and equipment.

- C. The Contractor shall be responsible for maintaining safe emergency exiting for the Government's and Contractor's personnel in all areas affected by the Contractors work.
- D. If operation of the Beale AFB's existing facility is adversely affected by the Contractor's work, the Government may make a claim against the Contractor to recover its loss.

END OF SECTION

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02220

DEMOLITION

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS
- 1.4 DUST CONTROL
- 1.5 PROTECTION
 - 1.5.1 Protection of Personnel
 - 1.5.2 Protection of Structures
 - 1.5.3 Protection of Existing Property
 - 1.5.4 Protection From the Weather
 - 1.5.5 Environmental Protection
- 1.6 BURNING
- 1.7 USE OF EXPLOSIVES

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

- 3.1 STRUCTURAL
- 3.2 PIPING AND UTILITIES
- 3.3 SALVAGED EQUIPMENT AND DISPOSITION OF DEBRIS
- 3.4 CONCRETE, PAVING, FENCING, AND MECHANICAL EQUIPMENT
- 3.5 CLEAN UP

-- End of Section Table of Contents --

SECTION 02220

DEMOLITION
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ENGINEERING MANUALS (EM)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 GENERAL REQUIREMENTS

A. This section applies primarily to the demolition of Building 700 and relocation of existing equipment (see drawing sheet C6.0 and photos at the end of this section)

B. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections. In the interest of conservation, salvage shall be pursued to the maximum extent possible; salvaged items and materials shall be disposed of as specified.

Prior to start of demolition, the Contractor shall first investigate the location of all utilities service, such as service pipelines, process pipelines, and electrical power and signal conductors which may be affected by the demolition operations (refer to Beale AFB digging permit requirements). The Contractor shall coordinate this investigation with the Contracting Officer and shall schedule all his demolition operations with the Contracting Officer at least 14 calendar days prior to start of work. The Contractor shall not begin demolition work until the Contracting Officer has favorably reviewed the Contractor's demolition schedule.

The Contractor shall limit the extent of demolition to only those features shown on the Drawings and otherwise found necessary to allow construction of the new work. Structures demolished or damaged by the Contractor unnecessarily shall be reconstructed by the Contractor at his expense to the extent and quality of the original construction.

The Contractor shall take care not to damage items which are indicated on the Drawings to be salvaged for reuse, such as sodium hypochlorite generation system and fencing. All items to be salvaged for reuse must be in suitable working order and approved by the Contracting Officer prior to reinstallation.

The Contractor shall schedule his demolition operations so as to make necessary provisions to prevent the entry of rainwater into the interior of existing structures, and otherwise protect the structures from all damage from the weather and direct sunlight until the construction is completed.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Demolition Plan; GA.

The Contractor will submit a demolition plan and will receive favorable review thereof prior to proceeding with demolition. The plan will be specific both with regard to how the demolition will be sequenced and the methods by which it will be carried out.

1.4 DUST CONTROL

The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

1.5 PROTECTION

1.5.1 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.5.2 Protection of Structures

Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until

demolished, unless directed otherwise by the Contracting Officer. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.5.3 Protection of Existing Property

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.5.4 Protection From the Weather

The interior of buildings to remain; salvageable materials and equipment shall be protected from the weather at all times.

1.5.5 Environmental Protection

The work shall comply with the requirements of Section 01410 ENVIRONMENT PROTECTION.

1.6 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.7 USE OF EXPLOSIVES

Use of explosives will not be permitted.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 STRUCTURAL

Perform structural demolition to the limits indicated on Drawing Sheet C6.0 and photographs at the end of this section.

The Contractor is cautioned that electrical conduits and reinforcing may be concealed in concrete and are not shown on any drawings. Use electronic detection equipment to locate concealed items before cutting holes. Take all required precautions to avoid damage to existing conduits or reinforcing.

3.2 PIPING AND UTILITIES

Remove piping and appurtenances to the limits indicated on the Drawings and/or photographs at the end of this section.

Prior to start of demolition, the Contractor shall de-energize and isolate all utility and process pipelines and all electrical conductors which may be affected by the demolition operations, and shall be prepared to disconnect, cap or close all such lines encountered during demolition. The Contractor shall remove all pipelines and electrical conductors to the extent shown on the Drawings or specified in the Specifications and necessary for the new construction.

Pipelines to be abandoned shall be severed cleanly, and properly plugged or capped outside of the new construction areas. Conductors to be abandoned shall be removed or cut off and the conduits properly sealed. Pipelines and conductors to remain in service shall be protected and properly supported during demolition operations until they can be incorporated into the new construction. Protect open ends of pipelines and conduits to prevent entry of foreign objects. The Contractor shall provide temporary by-pass pipelines and electrical circuits in-kind for those affected facilities to remain in service during demolition operations.

3.3 SALVAGED EQUIPMENT AND DISPOSITION OF DEBRIS

Building 700/701 Site - Refer to Drawing Sheet C6.0 and photographs at the end of this section.

Suitable and satisfactory materials as defined in Section 02301 Earthwork may be used for backfill, fill and embankments as allowed by these sections.

Unless otherwise noted, all other materials and debris resulting from the demolition work shall become the property of the Contractor and shall be disposed of by the Contractor off base.

3.4 CONCRETE, PAVING, FENCING, AND MECHANICAL EQUIPMENT

Remove concrete, paving, fencing, mechanical equipment, and other items, as shown, or noted to be removed, on the Drawings or photographs at the end of this section.

Existing pavements designated for removal shall be saw cut and removed in accordance with the drawings or the photographs. Any damaged pavement or cracked surfaces caused by the Contractor shall be recut to provide a smooth-square for the resurfacing. All pavement damaged by the Contractor shall be removed and replaced at his expense.

3.5 CLEAN UP

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02230

CLEARING AND GRUBBING

03/01

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Clearing

1.1.2 Grubbing

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

3.2 GRUBBING

3.3 TREE REMOVAL

3.4 DISPOSAL OF MATERIALS

-- End of Section Table of Contents --

SECTION 02230

CLEARING AND GRUBBING
03/01

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Clearing

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared.

1.1.2 Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work as noted on the Drawings.

3.2 GRUBBING

Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and

compacted to make the surface conform with the original adjacent surface of the ground.

3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.4 DISPOSAL OF MATERIALS

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of off Base at the Contractor's responsibility, except when otherwise directed in writing. Refer to Section 01410 Environmental Protection.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02300

EARTHWORK

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 ADDITIONAL SAFETY RESPONSIBILITIES
- 1.3 DEFINITIONS
 - 1.3.1 Satisfactory Material
 - 1.3.2 Unsatisfactory Material
- 1.4 SUBMITTALS
- 1.5 SUBSURFACE DATA
- 1.6 EXPLOSIVES
- 1.7 UTILIZATION OF EXCAVATED MATERIALS

PART 2 PRODUCTS

- 2.1 MATERIALS

PART 3 EXECUTION

- 3.1 CONTROL OF WATER
- 3.2 EXISTING UTILITIES
- 3.3 GENERAL CONSTRUCTION REQUIREMENTS
- 3.4 SITE GRADING
- 3.5 TRENCH EXCAVATION
- 3.6 EXCAVATION FOR STRUCTURES
- 3.7 SUPPORT OF EXCAVATIONS
- 3.8 BACKFILL
 - 3.8.1 Trench Backfill
 - 3.8.2 Structural Backfill
 - 3.8.3 Native Backfill
- 3.9 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS (NOT USED)
- 3.10 SUBGRADE PREPARATION
 - 3.10.1 Compaction
- 3.11 TESTING
- 3.12 FINISH GRADING

-- End of Section Table of Contents --

SECTION 02300

EARTHWORK

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 1140	(1997) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(1994) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and

Plasticity Index of Soils

Standard Specifications (1999) State of California, Department of Transportation

Manual of Test (California Test) State of California, Department of Transportation

29 CFR Part 1926 CalOSHA Subpart P excavations and Trenches

1.2 ADDITIONAL SAFETY RESPONSIBILITIES

The Contractor shall select, install and maintain shoring, sheeting, bracing, and sloping as necessary to maintain safe excavations. The Contractor shall be responsible for ensuring such measures: (1) comply fully with 29 CFR Part 1926 OSHA Subpart P Excavations and Trenches requirements, (2) provide necessary support to the sides of excavations, (3) provide safe access to the Contracting Officer's sampling and testing within the excavation, (4) provide safe access for backfill, compaction, and compaction testings, and (5) otherwise maintain excavations in a safe manner that shall not endanger property, life, health, or the project schedule. All earthwork shall be performed in strict accordance with applicable law, including local ordinances, applicable OSHA, CalOSHA, California Civil Code, and California Department of Industrial Safety requirements.

1.3 DEFINITIONS

1.3.1 Satisfactory Material

Satisfactory materials are materials that classify according to ASTM D 2487 and GW, GP, GC, GM, SW, SP, SC, SM, CL, ML, and combinations of these such as SP-SM, etc. In addition, satisfactory materials shall have a maximum particle size of 2 inches or less and shall be free of organic matter and debris. Onsite materials that meet this definition are satisfactory for building pads and subgrades, except for that soil placed below the 100,000 gallon backwash water storage tank.

1.3.2 Unsatisfactory Material

Unsatisfactory material include material classified according to ASTM D 2487 as MH, CH, OL, OH and PT

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Compaction Testing; FIO.

Potholing Report as described in Paragraph 3.2.

Sheeting and Shoring Plan: Refer to paragraph 1.2 above.

SD-13 Certificates

Source Quality Control; FIO.

Gravel plant gradation certificate for imported materials. Materials proposed for use to demonstrate that the materials conform to the specified requirements.

1.5 SUBSURFACE DATA

Subsurface soil boring logs are shown on the drawings. The subsoil investigation report and samples of materials taken from subsurface investigations was completed by the U.S. Army Corps of Engineers may be examined by bidders at U.S. Army Corps of Engineers, 1325 J Street, Sacramento, California. The data represents the best subsurface information available; however, variations may exist in the subsurface between boring locations. While the records of data obtained may be considered by the Contractor to be correct, any conclusions or recommendations made in the reports are for information to the Design Engineer and are not a part of the Contract Documents.

1.6 EXPLOSIVES

The use of explosives will not be permitted for this project.

1.7 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Excess satisfactory material shall be hauled and stockpiled by the Contractor at a designated location on base where directed by the Contracting Officer. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion in accordance with the plans. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way. Excess rock as determined by the Contracting Officer shall be hauled off base and disposed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Crushed Rock: Class 2, 3/4-inch maximum aggregate base, Standard Specifications Section 26.

B. Pipe Bedding Materials:

1. Sand: Standard Specifications, Paragraph 19-3.025B.
2. Permeable Material: Standard Specifications, Paragraph 68-1.025 Class I, Type A.

C. Import Backfill: Imported nonexpansive soil with liquid limit no greater than 40% and a plasticity index no greater than 15%, free from clods or rocks larger than 2 inches in greatest dimension, and free from organic material.

D. Native Backfill: Excess excavated material, or "spoil" consisting of native soil prepared as necessary to be free from clods or rocks larger than 2 inches in greatest dimension, and free from organic material.

E. Landscape Fill: Import backfill free from chemicals, salts or other materials harmful to plant growth.

F. Impervious Material: Clay with a minimum percentage of material passing the No. 200 sieve of 50%. The material shall be free of organics, rocks, or clods greater than 2 inches in diameter.

G. Water: The water used shall be reasonably free of objectionable quantities of silt, oil, organic matter, alkali, salts and other impurities. Water quality must be acceptable to the Contracting Officer.

H. Aggregate Base: Class 2, 3/4-inch maximum. Standard Specifications, Section 26.

PART 3 EXECUTION

3.1 CONTROL OF WATER

A. All excavations shall be kept free from water and all construction shall be in the dry.

1. It should be presumed that the presence of groundwater will require dewatering operations. Furnish, install, maintain, and operate all necessary pumping and other equipment for dewatering all excavations. At all times have on the project sufficient pumping equipment for immediate use, including standby pumps for use in case other pumps become inoperable.
2. Provide a sufficient number of pumps so as to hold the groundwater level at an elevation of not less than 1 foot below the lowest elevation of the pipe, duct or other material to be placed.
3. Dispose of water in such a manner as to cause no injury or nuisance to the property, or be a menace to the public health.
4. The dewatering operation shall be continuous, so that the excavated areas shall be kept free from water during construction, while concrete is setting and achieves full strength, and until backfill has been placed to a sufficient height to anchor the work against possible flotation.
5. Continue dewatering during backfilling operations such that the groundwater is at least 1 foot below the level of the compaction effort at all times. No compaction of saturated materials will be allowed.

6. Dewatering devices must be adequately filtered to prevent the removal of fines from the soil.

7. The Contractor shall be responsible for any damage to the foundations or any other parts of existing structures or of the new work caused by failure of any part of the Contractor's protective works. After temporary protective works are no longer needed for dewatering purposes, they shall be removed by the Contractor.

8 If pumping is required on a 24-hour basis, requiring engine drives, then engines shall be equipped in a manner to keep noise to a minimum.

9. Prevent disposal of sediments from the soils to adjacent lands or waterways by employing whatever methods are necessary, including settling basins.

B. The Contractor shall be responsible for furnishing temporary drainage facilities to convey and dispose of surface water falling on or passing over the site.

3.2 EXISTING UTILITIES

A. General: The known existing utilities and pipelines are shown on the Drawings in their approximate location. The Contractor shall exercise care in avoiding damage to all utilities as he will be held responsible for their repair if damaged. There is no guarantee that all utilities or obstructions are shown, or that locations indicated are accurate. Utilities are piping, conduits, wire, cable, ducts, manholes, pull boxes and the like, located at the project site and adjoining site.

Before performing any excavation, grading, trenching or other operations whereby existing underground utilities may be damaged, the Contractor shall obtain a digging permit by completing an AF Form 103. Note that this process may take two weeks, therefore the Contractor shall plan work accordingly. The digging permit will list points of contacts (POCs) and telephone numbers for each of the various underground utilities (Telephone, gas, water, electrical, etc..) existing in the work area. It shall be the Contractor's responsibility to contact POCs for each utility listed, request that any utilities existing in the work area be marked, and obtain each POC's certification on the form. After each POC has been contacted and has certified such by signing or initialing the form, the form shall then be delivered to the government inspector. The Government (or Owner, in the case of privately owned utilities such as telephone service) will be responsible for marking the location of utilities in the work area. Typically, flags and/or paint will be used to mark the each and/or pavement to provide semi-permanent identification of the utility location. No indication/marketing of the depth of the utility below the existing grade will be provided. The Contractor shall allow sufficient time for the Government to accomplish this task at no additional cost to the Government.

Once the utilities are marked, the Contractor shall be responsible for maintaining the flags/paint at their proper location(s). No excavation will be permitted until all utilities existing in the area have been marked. The Contractor shall be responsible for the repair of any underground utility is within a lateral zone 3 feet on either side of the Government/Commercial-provided mark indicating the location of that utility. This 3-foot zone on either side of the mark provided is a hand-dig only area. Since depth of the utility will not be provided, the

Contractor assumes responsibility for any depth determination necessary.

B. Check on Locations (Potholing): Contact all affected utility POCs and request them to locate their respective utilities prior to the start of "potholing" procedures. The utility POC shall be given 7 days written notice prior to commencing potholing. If a utility POC is not equipped to locate its utility, the Contractor shall locate it.

C. Clearly paint the location of all affected utility underground pipes, conduits and other utilities on the pavement or identify the location with suitable markers if not on pavement. In addition to the location of metallic pipes and conduits, non-metallic pipe, ducts and conduits shall also be similarly located using surface indicators and detection tape if present and shall then be similarly marked.

D. After the utility survey is completed, commence "potholing" to determine the actual location and elevation of all utilities where crossings, interferences, or connections to new pipelines or other facilities are shown on the Drawings, marked by the utility companies, or indicated by surface signs. Prior to the preparation of piping shop drawings, or the excavating for any new pipelines or structures, the Contractor shall locate and uncover these existing utilities to a point 1 foot below the utility. Submit a report identifying each underground utility and its depth and location. Any variation in the actual elevations and the indicated elevations shall be brought to the Contracting Officer's attention.

E. Excavations around underground electrical ducts and conduits shall be performed using extreme caution to prevent injury to workmen or damage to electrical ducts or conduits. Similar precautions shall be exercised around gas lines, telephone and television cables. Backfill after completing potholing.

F. Interferences: If interferences occur at locations other than shown on the Drawings, the Contractor shall notify the Contracting Officer, and a method for correcting said interferences shall be supplied by the Contracting Officer. If the Contractor does not expose all required utilities prior to shop drawing preparation, he shall not be entitled to additional compensation for work necessary to avoid interferences, nor for repair to damaged utilities.

G. Any necessary relocations of utilities, whether shown on the Drawings or not, shall be coordinated with the affected utility. The Contractor shall perform the relocation only if instructed to do so in writing from the utility and the Contracting Officer.

H. Shutdowns: Planned utility service shutdowns shall be accomplished during period of minimum use. In some cases this may require night or weekend work. Such work shall be at no additional cost to the Government. Program work so that service will be restored in the minimum possible time.

1. Disconnections: No utility shall be disconnected without prior written approval from the Contracting Officer. When it is necessary to disconnect a utility, the Contractor shall give the Contracting Officer not less than 14 days notice when requesting written approval. The

Contractor shall program the work so that service will be restored in the minimum possible time.

I. Overhead Facilities: There are existing overhead electric and telephone transmission lines at the site. These overhead utilities may not be completely shown on the Drawings. Extreme caution shall be used when working in the vicinity of overhead utilities so as to prevent injury to workmen or damage to the utilities. The Contractor shall be required to comply with the applicable provisions of the California Construction Safety Orders when working anywhere on this project.

3.3 GENERAL CONSTRUCTION REQUIREMENTS

A. Site Access: Access to the site will be over public and private roads. Exercise care in the use of such roads and repair at own expense any damage thereto caused by Contractor's operations. Such repair shall be to the satisfaction of the Government or agency having jurisdiction over the road. Take whatever means are necessary to prevent tracking of mud onto existing roads and shall keep roads free of debris.

B. Barriers: Barriers shall be placed at each end of all excavations and at such places along excavations as may be necessary to warn all pedestrian and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely restored.

C. Demolition of Pavement: Where trenching or excavation occurs in paved areas, the pavement shall be cut and removed ahead of the trenching or excavation operation. The extent of paving removed shall be limited to the minimum necessary for the excavation.

D. Dust Control: Take proper and efficient steps to control dust.

E. Permits: Refer to Paragraph 3.2A.

F. Storage of Materials: Neatly place excavated materials far enough from the excavation to prevent stability problems. Keep the materials shaped so as to cause the least possible interference with plant operations and drainage.

G. Existing Facilities: Maintain access to existing facilities to permit continued operation. Maintain access for fire fighting equipment and to fire hydrants.

3.4 SITE GRADING

A. Rough Grading: After completion of stripping, rough grade cut areas to the lines, grades and contours shown on the Drawings.

B. Proof-Rolling: After rough grading, proof-roll the areas where fills, and on-grade structures are to be constructed in order to detect soft zones. Proof-roll by passing over all required areas with a loaded scraper, front-end loader with loaded bucket, or other heavy rubber tired vehicle

with high tire pressure. The Contracting Officer will determine what areas tested by proof-rolling are soft zones that require corrective work.

1. Soft Zone Corrective Work: Remove all soft material as indicated by the Contracting Officer from all soft zones exposed by proof-rolling. Properly dispose of unsuitable material off site.
2. Fill the resulting voids with moisture-conditioned native backfill or import backfill, in level 8-inch uniform layers measured before compaction. Compact with appropriate equipment to between 88% and 93% relative compaction. Moisture condition to within 2% optimum water content.

C. Scarifying: Upon completion and favorable review of the soft zone correction work scarify to a minimum 6-inch depth all areas where fills are required. Moisture condition the scarified surface to within 2% of optimum water content, and compact to a minimum 90% relative compaction.

D. Fills:

1. Do not place any fill until the Contracting Officer has inspected, tested to his satisfaction, and favorably reviewed the prepared subgrade.
2. Construct fills as shown on the Drawings, true to line, grade and cross-section. Construct fills of native backfill or import backfill. Place material in approximately 8-inch-thick horizontal layers measured before compaction, and carried across the entire width to the required slopes. Compact all fills to a relative compaction of at least 90% unless otherwise specified. Properly moisture condition before compaction.
3. Where fills are to be made and compacted on sloping ground surfaces, steeper than 5:1, such slopes shall be benched a minimum of 6 feet horizontally as the work is brought up. Recompact material thus removed by benching along with the new embankment material.
4. It may be necessary to overbuild slopes and trim back to the compacted core to achieve adequate compaction of slope faces.

E. Ditches: Cut ditches accurately to the cross sections and grades shown. Take care not to overexcavate ditches, and backfill excessive excavation to grade. Trim all roots, stumps, rock and other foreign matter from the sides and bottom of the ditches. Compact the surfaces of ditch slopes and bottom.

3.5 TRENCH EXCAVATION

A. Excavation for pipe and other utilities such as conduits shall be in open cut. The trench shall be as wide as necessary for sheeting and bracing and the proper performance of the work up to the maximum width permitted by the typical cross-sections shown on the Drawings. The sides of the trenches shall be vertical in paved areas. The bottom of the trench shall be constructed to the grades and shapes indicated on the Drawings. Should the Contractor desire to use other equivalent methods, he shall submit his method of construction to the Contracting Officer for favorable review prior to its use.

B. Take care not to overexcavate. Accurately grade the bottom of the trenches to provide uniform bearing and support for each section of the pipe or conduit at every point along its entire length, except for the

portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints, and as hereinafter specified. Dig bell holes and depressions for joints after the trench bottom has been graded. In order that the pipe rest on the bedding for as nearly its full length as practicable, bell holes and depressions shall be only of such length, depth and width as required for properly making the joint. Remove stones as necessary to avoid point bearing.

C. Backfill and compact overexcavations to 95% relative compaction with bedding material. There shall be no additional payment to the Contractor for over-excavations not directed by the Contracting Officer.

D. Grade trenches so that they are uniformly sloped between the pipe elevations shown on the Drawings. If no elevations are shown on the Drawings, provide 3 feet of minimum cover. Comply with the minimum and maximum trench widths shown on the Drawings. Notify the Contracting Officer if the trench width exceeds the maximum allowable width for any reason.

E. For all piping or conduits to be placed in any excavated and backfilled area, such as at manholes or for building connections, the structural backfill shall be first compacted to a level at least 3 feet from the top of the piping or conduit elevation and then retrenched to pipe grade.

F. Provide ladders for access to the trench by construction and inspection personnel.

3.6 EXCAVATION FOR STRUCTURES

A. All excavation for structures shall be done to the dimensions and levels indicated on the Drawings or specified herein. Excavate to such width outside the lines of the structure to be constructed as may be required for proper working methods, the erection of forms and the protection of the work.

B. Take care to preserve the foundation surfaces in an undisturbed condition. If the Contractor overexcavates or disturbs the foundation surfaces, without written authorization of the Contracting Officer, he shall replace such foundations with concrete fill or other material approved by the Contracting Officer in a manner which will show by test an equal bearing value with the undisturbed foundation material. No additional payment will be made for the added quantity of concrete fill or other material used because of overexcavation.

C. Inspection of Excavation: Notify the Contracting Officer when excavation for the structure is complete. No forms, reinforcing steel, concrete, or precast structure shall be placed until the excavation has been inspected by the Contracting Officer.

D. Where unsatisfactory material is encountered below the grades for structural excavations, it shall be removed and replaced with structural fill material as directed by the Contracting Officer and compacted to 95% maximum density.

3.7 SUPPORT OF EXCAVATIONS

A. Adequately support excavation for trenches and structures to meet all applicable requirements in the current rules, orders and regulations. Excavation shall be adequately shored, braced and sheeted so that the earth will not slide or settle and so that all existing structures and all new pipe and structures will be fully protected from damage. Keep vehicles, equipment, and materials far enough from the excavation to prevent instability.

B. Take all necessary measures to protect excavations and adjacent improvements from running, caving, boiling, settling, or sliding soil resulting from the nature of the soil excavated. Attention is directed to Section 832 of the Civil Code of the State of California relating to lateral subadjacent supports, and wherever structures or improvements adjacent to the excavation may be damaged by such excavation, the Contractor shall comply with this law.

C. The support for excavation shall remain in place until the pipeline or structure has been completed. During the backfilling of the pipeline or structure, the shoring, sheeting and bracing shall be carefully removed so that there shall be no voids created and no caving, lateral movement or flowing of the subsoils.

3.8 BACKFILL

3.8.1 Trench Backfill

A. Place bedding and backfill materials true to the lines, grades, and cross-sections indicated on the Drawings and compacted to the degree specified on the Drawings. Place bedding and backfill materials in horizontal lifts not to exceed 8 inches in thickness measured before compaction. The difference in level on either side of a pipe shall not to exceed 4 inches.

B. Backfill material shall not be placed over the pipe or conduit until after the joints have been completed and inspected by the Contracting Officer.

C. It shall be incumbent upon the Contractor to protect the pipe or conduit from damage during the construction period. It shall be his responsibility to repair broken or damaged pipe at no extra cost to the Government. Carefully place backfill around and over the pipe and do not allow it to fall directly upon the pipe. Tamping of backfill over the pipe shall be done with tampers, vibratory rollers and other machines that will not injure or disturb the pipe.

D. Do not allow traffic over the pipe trench until the trench backfill has been brought back even with existing adjacent grade.

3.8.2 Structural Backfill

A. Crushed Rock Subgrade: Place a layer of rock, compacted to at least 95% relative compaction under structures to the lines, grades and minimum

thicknesses shown on the Drawings. Unless shown specifically otherwise in the Drawings, do not use rock as backfill above the elevation of the highest base slab of the structure.

B. Backfill Adjacent to Structures:

1. Backfill shall be structural backfill compacted to at least 90% relative compaction.
2. Do not place backfill against structures until the concrete has been patched and cured.
3. Do not place backfill against structures until at least 28 days after the concrete was placed, or until the concrete has achieved a strength of at least 2,500 psi, whichever is earlier. Concrete strength shall be demonstrated by field cured cylinders tested at the Contractor's cost, prepared and tested in accordance with ASTM C 31 and ASTM C 39.
4. Do not place backfill against hydraulic structures until the structure has passed the specified leakage tests.
5. Place backfill in uniform, level layers, not exceeding 8 inches thick measured before compaction. Bring backfill up uniformly on all sides of the structure, and on both sides of buried walls.

3.8.3 Native Backfill

- A. Moisture condition of native backfill material to within 2% of optimum moisture content. Place fill in lifts no thicker than 8 inches and compact soil to within a range of 90% relative compaction.

3.9 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS (NOT USED)

3.10 SUBGRADE PREPARATION

3.10.1 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

- A. Add water to the backfill material or dry the material as necessary to obtain a moisture content within 2% of optimum. Employ such means as may be necessary to secure a uniform moisture content throughout the material of each layer being compacted.

- B. After the material has been moisture conditioned, compact it with compaction equipment appropriate for the use to achieve specified compaction.

- C. If the backfill material becomes saturated from rains or any other source because it was not compacted to the specified density or was not backfilled and compacted to surface grade, through negligence or otherwise, remove the faulty material and replace it with suitable material compacted to the specified density. No additional payment will be made for doing such work or removal and replacement.

- D. Compaction of embankment and backfill materials by flooding,

ponding or jetting will not be permitted.

E. When densities of compacted materials do not meet the requirements, remove and/or recompact the material until the requirements are met. The Contractor is responsible for all compaction tests and retesting.

3.11 TESTING

Testing Methods:

1. Durability Index: Manual of Test (California Test), Department of Transportation.
2. Specific Gravity: ASTM D 854
3. Laboratory Compaction: ASTM D 1557, Method A or C.
4. In-place Density: ASTM D 1556 or ASTM D 2922.
5. Particle Size Analysis of Soils: ASTM D 422.
6. Plastic Limit and Plasticity Index: ASTM D 4318.
7. Soil Classification: ASTM D 2487.
8. In-place Moisture Content: ASTM D 3017.

3.12 FINISH GRADING

Finish grade the site to the elevations shown on the Drawings. Finish grading shall be uniform and pleasing and shall provide drainage from all areas to collection points. The finished surfaces shall be smooth and compacted.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02510

WATER SYSTEM PIPING AND ACCESSORIES

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUMMARY
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
- 1.5 POTHOLING
- 1.6 CONSTRUCTION SCHEDULING/SEQUENCING

PART 2 PRODUCTS

- 2.1 GENERAL
- 2.2 PIPING MATERIALS
- 2.3 PIPE COUPLINGS
- 2.4 VALVES AND ACCESSORIES
- 2.5 APPURTENANCES

PART 3 EXECUTION

- 3.1 PIPING INSTALLATION
- 3.2 COUPLING INSTALLATION
- 3.3 INSTALLATION OF VALVES AND ACCESSORIES
- 3.4 INSTALLATION OF THRUST BLOCK
- 3.5 FIELD QUALITY CONTROL
- 3.6 CLEANING
- 3.7 FIELD TESTING
- 3.8 DISINFECTION OF POTABLE WATER SYSTEMS

-- End of Section Table of Contents --

SECTION 02510

WATER SYSTEM PIPING AND ACCESSORIES
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Association of State Highway and Transportation Officials
(AASHTO)

American National Standards Institute (ANSI)

American Society of Mechanical Engineers (ASME)

American Society for Testing and Materials (ASTM)

American Water Works Association (AWWA)

Cast Iron Soil Pipe Institute

1.2 SUMMARY

A. This section applies to the water distribution system piping only at the Housing Area (Drawing Sheets P1.0 to P6.0). For requirements of pipelines and liquid process piping at the water treatment plant refer to Section 15200.

B. Section Includes: Furnish and install all water distribution system piping, including fittings, valves, and accessories as shown on the Drawings, described in the Specifications and as required to completely interconnect all piping for a complete and operable system.

C. Related Sections:

1. Section 02300: Earthwork
2. Section 15200: Pipelines, Liquid Process Piping

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Data; FIO.

Submit data to show that the following items conform to the Specification requirements:

1. Pipe, fittings, and accessories.
2. Flexible couplings and flanged coupling adapters.
3. Restrained joints.
4. Valves and meters.

SD-04 Drawings

Shop Drawings; FIO.

Submit shop drawings if layouts are different from the Contract Plans.

Layouts and schematics: Submit detailed installation drawings of all piping and connected equipment. The drawings shall include each pipe, all fittings, valves, and other appurtenances.

SD-08 Statements

Procedures; FIO.

Disinfection schedule and procedures including:

1. Disinfection procedure.
2. Disinfecting agent(s).
3. Method of disposal of chlorinated water.

SD-19 Operation and Maintenance Manuals

Manuals; FIO

The Contractor shall furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for the following items:

All valves over 4-inch size.
Water meters.

1.4 QUALITY ASSURANCE

All materials and equipment furnished under this Section shall: (1) be of a manufacturer who has been regularly engaged in the design and manufacture of the materials and equipment and (2) be demonstrated that the quality is equal to the materials and equipment made by those manufacturers specifically named herein, if an alternate product manufacturer is proposed.

1.5 POTHOLING (CHECK ON LOCATIONS - The Contractor shall verify existing utilities and conditions, prior to ordering materials)

Do not prepare any shop drawings for, or make final order for, or design any pipe materials for any particular section of pipeline until all utilities in that section of pipeline have been exposed, as specified in paragraph 3.2 of Section 02300 and until such time as no interferences are

found between said existing utilities and the proposed pipeline alignment. If interferences are found in any particular section of pipeline, do not prepare any shop drawings for, or make final order for, or design any pipe materials for that particular section of pipeline until the pipeline alignment has been modified by the Contracting Officer and/or the Engineer to eliminate all such interferences.

1.6 CONSTRUCTION SCHEDULING/SEQUENCING

A. Construction under this Contract involves new water treatment plant. Existing water system must continue to provide service during construction. All scheduled outages shall be approved by the Contracting Officer.

B. Utilities connections and changes must be programmed to provide the least possible interruptions of service. Prior to any shutdown, all materials, fittings, supports, equipment and tools shall be on the site and all necessary labor scheduled prior to starting any connection work. The Contractor shall notify the Contracting Officer in writing at least 14 days in advance of any required shutdowns so that affected customers may be notified. In general, shutdowns shall not exceed four hours in duration unless specifically authorized or indicated in the suggested construction sequence. If a shutdown of more than four hours is required, the Contractor shall first install temporary water service connections to all affected houses and other buildings. All temporary piping shall be disinfected in accordance with Paragraph 3.7 before being put into service. No utility interruption will be permitted without the prior approval of the Contracting Officer.

C. All work under this Contract shall be conducted in a manner which will minimize shutdowns, open trenches, or traffic obstructions caused by the construction. Shutdowns causing damage to government facilities and property shall not be permitted, and any damage resulting shall be the sole responsibility of the Contractor.

PART 2 PRODUCTS

2.1 GENERAL

A. Pipe and valve sizes are nominal inside diameter unless otherwise noted.

B. All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.

C. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the completed product. Acceptance of installed piping systems shall be based on inspection and leakage and bacteriological tests as specified hereinafter.

D. Buried nuts and bolts for flanges and couplings shall be Type 304 stainless steel unless otherwise specifically specified herein.

2.2 PIPING MATERIALS

- A. Pipe Designation: Piping materials are designated on the Drawings.
- B. Pipe Systems: Each designation identifies not only the pipe itself, but the entire system as well as including the associated fittings, appurtenances, and installation and test procedures.
- C. Ductile Iron (DI):
 - 1. Pipe: Ductile iron, Pressure Class 250, AWWA C151.
 - 2. Joints: Push-on, AWWA C111 as modified.
 - a. Gaskets: Natural rubber or neoprene.
 - b. Restrained joints: Where required by the Drawings, provide restrained joints capable of deflection. Joints shall not separate under an internal pressure of 250 psi. Mega-Lug by EBAA Iron, Inc. or equal.
 - 3. Fittings: Ductile iron or cast iron push-on joints, AWWA C110.
 - a. Special Fittings: Special fittings not available in ductile iron or cast iron pipe may be fabricated of fusion epoxy lined and coated welded steel pipe with a design pressure of 250 psi.
 - 4. Flanged pipe: Where flanges are necessary for connections to equipment or for insulated joints, pipe shall be thickness Class 53, AWWA C115.
- D. Polyvinyl Chloride Pipe:
 - 1. Pipe: Polyvinyl chloride pressure pipe, cast iron pipe outside dimensions. Pipe shall be UL listed or Factory Mutual Approved.
 - a. 4-inch through 12-inch: AWWA C900.
 - b. 14-inch through 36-inch: AWWA C905.
 - 2. Dimension ratio: 26.
 - 3. Joints:
 - a. Unrestrained joints: Bell and spigot, gasketed; or twin gasket coupling.
 - b. Restrained joints: Bell and spigot (push-on) gasketed, or mechanical joints; both using ductile iron clamp-on restraining devices.
 - 1) Restraining devices: Ductile iron with ductile iron or cor-ten rods and bolts. Pressure rating of at least 150 psi. Series 1500 by EBBA Iron; equivalent by Uni-Flange; or equal for bell and spigot joints. Series 500 by EBBA Iron; equivalent by Uni-Flange; or equal for mechanical joints.
 - 4. Gaskets: Isoprene.
 - 5. Fittings: Push-on cast iron or mechanical joint, AWWA C110, with hubs cast and/or ground as required for pipe furnished.

2.3 PIPE COUPLINGS

- A. General: For typical pipe joints refer to pipe material specifications. Other joint devices shall be furnished where called for as specified below.
- B. Flexible Couplings and Flange Coupling Adaptors:
 - 1. Sleeve: Cast iron or fabricated steel.
 - 2. Followers: Cast iron, ductile iron, or steel.
 - 3. Sleeve bolts: ASTM A325, Type 3; stainless steel; or equivalent.

4. Coating: Fusion epoxy line and coat sleeve and followers.
5. Pressure rating: 250 psi.
6. Buried flexible coupling sleeve: Long barrel
7. Manufacturers:
 - a. Flexible couplings:
 - 1) Connecting pipe with identical outside diameters: Smith-Blair 411 or 431, Dresser Style 38 or 53, or equal.
 - 2) Connecting pipe with slightly different outside diameters: Smith-Blair 413 or R 441, Dresser Style 162, or equal.
 - b. Flange coupling adaptors:
 - 1) Connecting new pipe or new pipe to existing non-ferrous pipe: Smith-Blair 912 or 913, Dresser Style 127 or 128, or equal.
 - 2) Connecting new pipe to existing ferrous pipe: Insulating flange coupling adaptor with insulating boot: Smith-Blair 932 or 933, or equal.
8. Gaskets: Oil and grease resistant; Smith-Blair Grade 60; or equal.
9. Joint restraint: Provide joint harnesses (tie rod lug or attachment plate assemblies) across flexible couplings and flange coupling adaptors where indicated on the Drawings. Design restraint in accordance with AWWA M-11 for 250 psi if size of the rods are not indicated on the Drawings. Provide lug type joint restraint as manufactured by EBBA-Iron or equal. Anchor studs will not be allowed except on a minimum thickness Class DI pipe Special Class 50.
10. Protection for buried connectors and adaptors: Double wrap with polyethylene encasement, AWWA C105 and tape the edges of the encasement with PVC tape.

2.4 VALVES AND ACCESSORIES

- A. General Requirements for Valves:
 1. All valves of each type shall be the product of one manufacturer.
 2. All valves shall be furnished with control assembly, operators, handwheels, levers, or other suitable type wrench including handles as specified herein or as shown on the Drawings.
 3. All threaded stem valves shall open by turning the valve stem counter-clockwise.
 4. The exterior of all valves and valve operators shall be painted with two coats of Tape Coat Mastic; Protecto Wrap CA1180 Mastic; or equal, except where otherwise indicated.
- B. Valves and Accessories:
 1. Butterfly valves:
 - a. Rating: 150 psi water. Leaktight in both directions.
 - b. Type: Flanged body, or as shown on the Drawings, AWWA C504, geared operator, resilient seated, 90 degree seating.
 - c. Connections: Flange, as shown on the Drawings.
 - d. Materials: Cast iron body; cast iron or ductile iron disc with Ni-Chrome or Type 316 stainless steel edge; Type 304 stainless steel shaft; disc to be secured to shaft with Type 304 stainless steel taper pins.
 - e. Operator: Traveling-nut type, 2-inch standard AWWA nut, designed for buried service, watertight to 10 psi with extension stem as detailed on the Drawings. Provide three valve operator tee handles to the Contracting Officer.

- f. Valve seat: Buna-N seat shall be applied to the valve body.
 - g. Bearings: Self-lubricating and corrosion resistant.
 - h. Finish: Internal, asphalt varnish in accordance with AWWA C504; external, factory applied coal tar epoxy, 16 mils minimum thickness.
 - i. Manufacturers: Pratt Groundhog, or equivalent by DeZurik, or equal.
- 2. Gate Valves:
 - a. Rating: 200 psi water
 - b. Type: Resilient seated, non-rising stem, AWWA C509, as modified herein
 - c. Connection: Flanged or as shown on the Drawings
 - d. Stem seal: O-ring
 - e. Finish: Fusion epoxy
 - f. Manufacturers: American Darling CRS-80; Mueller; or equal.
- 3. Water meters: (Refer to Section 13405).
- 4. Valve boxes, adjustable screw type:
 - a. Materials: Cast iron, top and center sections and base and cover.

2.5 APPURTENANCES

Provide all necessary assembly bolts, washers and nuts, thrust blocks, supports, gaskets, flanges, adapters, connections and all other appurtenant items shown on the Drawings, specified or required for the proper installation and operation of the piping, and devices included in or on the piping, equipment, and piping accessories.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

- A. General Handling and Placing:
 - 1. Exercise great care to prevent injury to or scoring of the pipe lining and coating, as applicable, during handling, transportation or storage. Handle fusion epoxy coated pipe in accordance with AWWA C213. Pipe shall not be stored on rough ground and rolling of the pipe on the coating will not be permitted. Repair any damaged pipe sections, specials, or fittings or replace at the direction of the Contracting Officer.
 - 2. Inspect each pipe fitting, valve and accessory carefully before installation. Inspect the interior and exterior protective coatings and patch all damaged areas in the field or replaced at the direction of the Contracting Officer.
 - 3. Place or erect all piping to accurate line and grade and backfill, support, hang, or brace against movement as specified or shown on the Drawings, or as required for proper installation. Remove all dirt and foreign matter from the pipe interior prior to installation and thoroughly clean all joints before joining.
 - 4. Use reducing fittings where any change in pipe size occurs. Bushings shall not be used, unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.
 - 5. Connections between ferrous and non-ferrous piping and accessories

shall be made using a dielectric coupling, union, or flange.

B. General Buried Piping Installation:

1. Trenching, bedding, and backfill for buried piping shall be as shown on the Drawings and as specified in Section 02300.
2. Where no grade elevations are shown on the Drawings, buried piping shall have at least 3 feet of cover.
3. Provide each pipe with a firm, uniform bearing for its full length in the trench except at field joints. Do not lay pipe in water or when trench conditions or weather are unsuitable for such work.
4. Protect buried piping against thrust by use of restrained pipe joints, or thrust blocks if shown on the Drawings. Securely brace all exposed free pipe ends.
5. Do not pull bell and spigot, gasketed joints more than 75% of the maximum deflection permitted by the pipe manufacturer.

C. Water Main Installation:

1. The Contractor is advised that precautions taken to keep the pipeline clean during construction will facilitate achieving the disinfection requirements of this project with a minimum of effort and expense. Compliance with these suggested minimum procedures will not relieve the Contractor of the disinfection requirements.
2. Prior to installation, thoroughly clean the interior of each length of pipe and each fitting or valve and inspect to ensure that no foreign material remains. Cover both ends with plastic and do not uncover them until just prior to completing the joint.
3. Whenever pipe laying is discontinued for short periods, or whenever work is stopped at the end of the day, close the open ends of the pipe with watertight plugs or bulkheads.
4. Provide adequate trench pumping to ensure against groundwater contacting the inside of the pipeline at any time. Do not lower any pipe or fitting into a trench where groundwater is present and may enter the pipe. When necessary, pump the water from trenches and keep the trench dry until the joints have been completed and the open ends of the pipe have been closed with a watertight plug. Do not remove the plug until the trench has again been pumped dry.
5. Keep new pipe sections clean and dry.
6. When making the connection between a new pipeline and an existing pipeline, or when repairing a damaged pipe, take the following extra precautions:
 - a. Clean the exterior of the existing pipeline of all dirt and debris, and spray or swab with a standard 5.25% or stronger chlorine solution in the immediate vicinity of the work. Clean equipment and materials, including new pipe and fittings, to be used in making these connections of all dirt and debris and disinfect them. Allow at least 30 minutes contact time for disinfection before the chlorine solution is diluted or rinsed off. Provide sufficient trench pumps to prevent flooding of the trench.
 - b. When an old line is opened, either by accident or by design, the excavation may be wet or badly contaminated from groundwater. Apply liberal quantities of standard chlorine solution or tablets to the open trench areas to lessen the danger from such pollution. Tablets are recommended because they dissolve slowly and continue

to release hypochlorite as water is pumped from the excavation. Scatter liberally around and locate the tablets so that flow entering the work site will contact the disinfecting agent. Trench application should be done very carefully to avoid contact by skin and clothing with chlorine solution. Minimally, safety dictates wearing safety goggles and rain gear.

c. When excavating a leaking or broken pipeline, "valve-off" the system gradually to less than watertightness. This is to prevent causing areas of zero pressure which would allow entry of foreign material. A flow should be maintained which is slightly less than trench pump capability. Once the break is exposed and cleaned to disallow site contamination, the valving can then be made watertight.

D. Installation Specifics:

1. Ductile Iron Pipe:

a. Buried pipe shall be installed in accordance with AWWA C600.

b. Wherever the pipeline crosses over or under a sewer main or house service lateral, center a standard length pipe, 18-foot minimum, on said sewer main or lateral so as to have the pipeline joints as far as possible away from the sewer. This may require field cutting of some pipe pieces.

c. Flanged Joints: Flanged joints shall be made up tight with care being taken to avoid undue strain in the flanges, fittings, and other accessories. Bolt holes shall be aligned for each flanged joint. Bolts shall be full size for bolt holes; use of undersize bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Adjoining flange faces shall not be out of parallel to such a degree that the flanged joint cannot be made watertight without over-straining the flange.

Replace any flanged pipe or fitting whose dimensions do not allow the making of a proper flanged joint as specified herein by one of proper dimensions. Clean flanges prior to making joints.

d. Restrained Joints: Install in accordance with manufacturer's instructions. Pull slack out of joint after makeup.

2. Polyvinyl Chloride Pipe: Installation shall conform to AWWA M23, Chapters 6 and 7, as modified herein.

3.2 COUPLING INSTALLATION

Flexible Couplings and Flange Coupling Adaptors: Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Care shall be taken that the gaskets are wiped clean before they are installed. If necessary, flexible couplings and flanged coupling adapter gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Bolts shall be tightened progressively, drawing up bolt on opposite sides a little at a time until all bolts have a uniform tightness. Workers tightening bolts shall be equipped with torque-limiting wrenches or other favorably reviewed type. Anchor studs on restrained flanged coupling adapters shall be installed so as to lock into holes drilled through pipe wall in accordance with manufacturer's recommendation.

3.3 INSTALLATION OF VALVES AND ACCESSORIES

Use reducing fittings where any change in pipe size occurs between valves or accessories and the attached pipeline. Bushings shall not be used, unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines. Inspect each piece of pipe and each fitting carefully to see that there is no defective workmanship on pipe, or obstructions in pipes and fittings.

3.4 INSTALLATION OF THRUST BLOCK

Thrust blocks of 4,000 psi compressive strength concrete shall be cast-in-place at all horizontal or vertical bends of 11-1/4 degrees angle or more, behind each plug, cap, tee, or cross. The thrust block shall extend from the fitting to undisturbed soil, shall be kept clear of the joints, and shall be of such bearing area as to assure adequate resistance to the force to be encountered. Size of blocking shall be in accordance with the Drawing.

3.5 FIELD QUALITY CONTROL

- A. The Government will:
 - 1. Inspect field welds and test the welds if it is deemed necessary.
 - 2. Perform bacteriological analysis for pipelines to be disinfected.
- B. Factory Quality Control: The Contractor shall test all products as required herein and by the reference specifications.
- C. The Contractor shall:
 - 1. Perform leakage tests.
 - 2. Be responsible for the costs of additional inspection and retesting by the Government resulting from non-compliance.

3.6 CLEANING

Prior to testing, the inside of each completed pipeline shall be thoroughly cleaned of all dirt, loose scale, sand and other foreign material. Cleaning shall be by sweeping, flushing with water, internal cleaning device or "pig" or blowing with compressed air, as appropriate for the size and type of pipe. Flushing shall achieve a velocity of at least 3 feet per second. The Contractor shall install temporary strainers, temporarily disconnect equipment or take other appropriate measures to protect equipment while cleaning piping. Cleaning shall be completed after any repairs.

3.7 FIELD TESTING

- A. General: Perform leakage tests on all pipe installed in this project. Furnish all equipment, material, personnel, test media and supplies to perform the tests and make all taps and other necessary temporary connections. The test pressure, allowable leakage and test medium shall be as specified. Perform leakage tests on all piping at a time agreed upon and in the presence of the Contracting Officer.

B. Buried Piping: Perform the leakage test for buried piping after all pipe is installed and backfilled. However, preliminary tests may be conducted prior to backfill. If preliminary tests are conducted, provide any necessary temporary thrust restraint.

C. Accessories: It is the responsibility of the Contractor to block off or remove equipment, valves, gauges, etc., which are not designed to withstand the full test pressure.

D. Testing Apparatus: Provide pipe taps, nozzles and connections as necessary in piping to permit testing, addition of test media, and draining lines and disposal of water, as is necessary. Plug these openings in a manner favorably reviewed by the Contracting Officer after use. Provide all required temporary bulkheads.

E. Correction of Defects: If leakage exceeds the allowable, repair or replace the installation and repeat leakage tests as necessary until conformance to the leakage test requirements specified herein have been fulfilled. All visible leaks shall be repaired even if the pipeline passes the allowable leakage test.

F. Reports: Keep records of each piping test, including:

1. Description and identification of piping tested.
2. Test pressure.
3. Date of test.
4. Witnessing by Contractor and Contracting Officer and/or designated representative.
5. Test evaluation.
6. Remarks, to include such items as:
 - a. Leaks (type, location).
 - b. Repairs made on leaks.
 - c. Submit test reports to the Contracting Officer.

G. Venting: Where not shown on the Drawings, the Contractor may install valved "TEES" or corporation stops and saddles at high points on piping to permit venting of air. Valves shall be capped after testing is completed.

H. Testing Specifics:

1. Water Transmission Mains:
 - a. Method: AWWA C600, as modified herein.
 - b. Duration: Four hours.
 - c. Pressure: 150 psi measured at lowest point of section of pipeline being tested.
 - d. Medium: Potable water.
 - e. Allowable Leakage: Leakage shall be defined as the quantity of test medium that must be added to the section of pipeline being tested to maintain the specified test pressure for the specified test duration. Maximum allowable leakage shall be as specified in AWWA C600.
2. Copper and Galvanized Steel Pipe:
 - a. Duration: Four hours.
 - b. Pressure: 150 psi.
 - c. Medium: Water.
 - d. Allowable Leakage: None.

3.8 DISINFECTION OF POTABLE WATER SYSTEMS

- A. Disinfect all water mains and interconnected piping after testing and before being placed into service to ensure their bacteriological safety. Disinfection shall be accomplished under the supervision of the Contractor by a person skilled and experienced in the operation of water systems. Following disinfection and flushing, the Contracting Officer will take water samples for bacteriological analysis of the water. If the specified bacteriological requirements are not satisfied, the disinfection procedure must be repeated until the requirements are met.
- B. Mains:
1. Standard: AWWA C651 as amended herein.
 2. Forms of Chlorine: Sodium hypochlorite or calcium hypochlorite.
 3. Method: Continuous-Feed.
- C. Small Pipelines (less than 3 inch):
1. Preparation: Provide the system with a 1-inch minimum service cock or valve or other means to inject chlorine solution at a point within 2 or 3 feet of its junction with the supply source. When system is complete thoroughly flush it by fully opening every outlet until clear water flows from all of them.
 2. Disinfecting Agent: Sodium hypochlorite or calcium hypochlorite in sufficient quantities to produce chlorine concentration of at least 50 parts per million in the system.
 3. Disinfecting Procedure:
 - a. Connect a hand-operated pump, or other means of injecting the disinfecting agent, to 1-inch minimum service cock or valve or other injection device. Pump must provide a pressure greater than that of supply of system.
 - b. With system completely full of water and supply valve open, proceed to adjust every outlet of system so that a trickle of water flows from each.
 - c. Inject disinfectant slowly and continuously at an even rate, not in slugs, until a test at each outlet shows a free chlorine residual concentration of at least 50 parts per million.
 - d. Close all outlets and valves, including valve connecting to supply line and 1-inch minimum service cock on solution injection connection. Maintain condition for 24 hours. After 24 hours test for residual chlorine at each outlet. The free residual chlorine concentration indicated should be not less than 10 ppm. If the indicated free chlorine concentration is less than 10 ppm, the disinfection procedure must be repeated until an approved result is obtained.
 4. When the above procedure has been completed to the satisfaction of the Contracting Officer, flush out entire system with fresh water until tests at all outlets show a residual of not more than 0.5 ppm.
- D. Chlorine Residual Testing: AWWA C651, Appendix A, DPD Drop Dilution Method, except where otherwise specified.
- E. Bacteriological Analyses of Water: After the completion of disinfecting procedure, including the final flushing as described

heretofore, the Contracting Officer will obtain water samples from this system for bacteriological analyses. Requirements for satisfactory disinfection of water supply are that bacteriological analyses (Heterotrophic plate count) indicate that water samples are negative for coliformmerogenes organisms, and that total plate count is less than 100 bacteria per cubic centimeter. If bacteriological analyses do not satisfy the above requirements, then disinfection procedure must be repeated until these requirements are met.

F. Disposal of Disinfection Solution: Dechlorinate and dispose of disinfection solution in accordance with applicable regulations. Take care to assure that chlorinated water is not spilled in drains.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02531

SANITARY SEWERS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 PIPE
 - 2.1.1 Plastic Pipe
 - 2.1.1.1 PVC Pipe
- 2.2 REQUIREMENTS FOR FITTINGS
 - 2.2.1 Fittings for Plastic Pipe
- 2.3 JOINTS
 - 2.3.1 Plastic Pipe Jointing
- 2.4 BRANCH CONNECTIONS
- 2.5 FRAMES AND COVERS
- 2.6 STEEL LADDER
- 2.7 CEMENT MORTAR
 - 2.7.1 Portland Cement
- 2.8 STRUCTURES
 - 2.8.1 Precast Reinforced Concrete Manhole Sections

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Pipe Laying
 - 3.1.1.1 Trenches
 - 3.1.1.2 Backfill
 - 3.1.1.3 Handling and Storage
 - 3.1.2 Leakage Tests
- 3.2 MANHOLE DETAILS
 - 3.2.1 General Requirements
 - 3.2.2 Steel Ladder Anchorage
 - 3.2.3 Jointing, Plastering and Sealing
 - 3.2.4 Setting of Frames and Covers
- 3.3 CLEANOUTS AND OTHER APPURTENANCES

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 02531

SANITARY SEWERS

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 74	(1998) Cast Iron Soil Pipe and Fittings
ASTM A 123/A 123M	(1997a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM C 14	(1995) Concrete Sewer, Storm Drain, and Culvert PipeASTM C 14M
	(1995) Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)ASTM C 33
	(1993) Concrete AggregatesASTM C 76
	(1998) Reinforced Concrete Culvert, Storm Drain, and Sewer PipeASTM C 76M
	(1998) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)ASTM C 94
	(1998) Ready-Mixed ConcreteASTM C 150
	(1997) Portland Cement
ASTM C 260	(1998) Air-Entraining Admixtures for ConcreteASTM C 270
	(1997a) Mortar for Unit Masonry
ASTM C 425	(1998) Compression Joints for Vitrified Clay Pipe and FittingsASTM C 443
	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber GasketsASTM
C 443M	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric)ASTM C 478
	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)ASTM C 564
	(1997) Rubber Gaskets for Cast Iron Soil Pipe and FittingsASTM C 700
	(1997) Vitrified Clay Pipe, Extra

ASTM C 828	Strength, Standard Strength, and Perforated (1998) Low-Pressure Air Test of Vitrified Clay Pipe LinesASTM C 924 (1989; R 1997) Concrete Pipe Sewer Lines by Low-Pressure Air Test MethodASTM C 972
ASTM D 412	(1995) Compression-Recovery of Tape Sealant (1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 624	(1991; R 1998) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D 1784	(1999) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2680	(1995a) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 2996	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) PipeASTM D 2997 (1995) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin) PipeASTM D 3034 (1998) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3262	(1996) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer PipeASTM D 3350 (1996) Polyethylene Plastics Pipe and Fittings MaterialsASTM D 3753 (1981; R 1991) Glass-Fiber-Reinforced Polyester ManholesASTM D 3840 (1988) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure ApplicationsASTM D 4161 (1996) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe Joints Using Flexible Elastomeric SealsASTM F 402 (1993) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

- ASTM F 477 (1996a) Elastomeric Seals (Gaskets) for Joining Plastic PipeASTM F 714
- 794 (1997) Polyethylene (PE) Plastic pipe (SDR-PR) Based on Outside DiameterASTM F (1997) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
- ASTM F 894 (1998) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain PipeASTM F 949 (1996a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings
- AMERICAN WATER WORKS ASSOCIATION (AWWA)AWWA C105
- (1993) Polyethylene Encasement for Ductile-Iron Pipe SystemsAWWA C110
- (1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other LiquidsAWWA C111
- (1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- AWWA C115 (1996) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
- AWWA C151 (1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
- NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
- NFPA 49 (1994) Hazardous Chemicals Data
- NFPA 325-1 (1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
- NFPA 704 (1996) Identification of the Fire Hazards of Materials for Emergency Response
- UNI-BELL PVC PIPE ASSOCIATION (UBPPA)
- UBPPA UNI-B-6 (1990) Recommended Practice for the Low-Pressure Air Testing of Installed Sewer Pipe
- UBPPA UNI-B-9 (1990; Addenda 1994) Recommended Performance Specification for Polyvinyl Chloride (PVC) Profile Wall Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter (Nominal Pipe Sizes 4-48 inch)

1.2 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and

building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Data; FIO

Submit data to show that the products specified in this Section conform to the Specifications requirements.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PVC Pipe

ASTM D 3034, Type PSM with a maximum SDR of 35, Size 15 inches or less in diameter. ASTM F 949 for corrugated sewer pipes with a smooth interior. UBPPA UNI-B-9 and ASTM F 794, Series 46, for ribbed sewer pipe with smooth interior, size 8 inch through 48 inch diameters. PVC shall be certified by the compounder as meeting the requirements of ASTM D 1784, cell Class 12454B. The pipe stiffness shall be greater than or equal to 735/D for cohesionless material pipe trench backfills.

2.2 REQUIREMENTS FOR FITTINGS

Fittings shall be compatible with the pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and other requirements specified below.

2.2.1 Fittings for Plastic Pipe

ABS and PVC composite sewer pipe fittings shall conform to ASTM D 2680.

2.3 JOINTS

Joints installation shall comply with the manufacturer's instructions.

2.3.1 Plastic Pipe Jointing

Flexible plastic pipe (PVC or high density polyethylene pipe) gasketed joints shall conform to ASTM D 3212.

2.4 BRANCH CONNECTIONS

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

2.5 FRAMES AND COVERS

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. Reinforced concrete frames and covers shall be as indicated or shall conform to ASTM C 478. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.6 STEEL LADDER

A steel ladder shall be provided where the depth of a manhole exceeds 12 feet. The ladder shall not be less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123/A 123M.

2.7 CEMENT MORTAR

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.7.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in manholes.

2.8 STRUCTURES

2.8.1 Precast Reinforced Concrete Manhole Sections

Precast reinforced concrete manhole sections shall conform to ASTM C 478,

except that portland cement shall be as specified herein. Joints shall be cement mortar, an approved mastic, rubber gaskets, a combination of these types; or the use of external preformed rubber joint seals and extruded rolls of rubber with mastic adhesive on one side.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Pipe Laying

- a. Pipe shall be protected during handling against impact shocks and free fall; the pipe interior shall be free of extraneous material.
- b. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. As the work progresses, the interior of the sewer shall be cleared of all superfluous materials.
- c. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.
- d. Installations of solvent weld joint pipe, using PVC pipe and fittings shall be in accordance with ASTM F 402. The Contractor shall ensure adequate trench ventilation and protection for workers installing the pipe.

3.1.1.1 Trenches

Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

3.1.1.2 Backfill

As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade. Plastic pipe shall be completely covered to prevent damage from ultraviolet light.

3.1.1.3 Handling and Storage

Pipe, fittings and joint material shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities for plastic pipe, fittings, joint materials and solvents shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49

and NFPA 325-1.

3.1.2 Leakage Tests

Lines shall be tested for leakage by low pressure air testing, infiltration tests or exfiltration tests, as appropriate. Low pressure air testing for PVC pipe shall be as prescribed in UBPPA UNI-B-6. Prior to infiltration or exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. When the Contracting Officer determines that infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed 25 gal per inch diameter per mile of pipeline per day. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Government.

3.2 MANHOLE DETAILS

3.2.1 General Requirements

Manholes shall be constructed of precast concrete manhole sections. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. Pipe connections shall be made to manhole using water stops, standard O-ring joints, special manhole coupling, or shall be made in accordance with the manufacturer's recommendation. The Contractor's proposed method of connection, list of materials selected, and specials required, shall be approved prior to installation. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot. Free drop inside the manholes shall not exceed 18 inches, measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels; drop manholes shall be constructed whenever the free drop would otherwise be greater than 1 foot 6 inches.

3.2.2 Steel Ladder Anchorage

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet apart vertically, and shall be installed to provide at least 6 inches of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

3.2.3 Jointing, Plastering and Sealing

Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Mortar and mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer. Precast rings may also be sealed by the use of extruded rolls of rubber with mastic adhesive on one side.

3.2.4 Setting of Frames and Covers

Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 2 inches higher than finished grade in unpaved areas. Frame and cover assemblies shall be sealed to manhole sections using external preformed rubber joint seals that meet the requirements of ASTM D 412 and ASTM D 624, or other methods specified in paragraph Jointing, Plastering and Sealing, unless otherwise specified.

3.3 CLEANOUTS AND OTHER APPURTENANCES

Cleanouts and other appurtenances shall be installed where shown on the drawings or as directed by the Contracting Officer, and shall conform to the details on the drawings.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02630

STORM-DRAINAGE SYSTEM

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING
 - 1.3.1 Delivery and Storage
 - 1.3.2 Handling

PART 2 PRODUCTS

- 2.1 PIPE FOR CULVERTS AND STORM DRAINS
 - 2.1.1 Corrugated Steel Pipe
- 2.2 DRAINAGE STRUCTURES
 - 2.2.1 Flared End Sections
- 2.3 MISCELLANEOUS MATERIALS
 - 2.3.1 Joints
 - 2.3.1.1 Flexible Watertight, Gasketed Joints

PART 3 EXECUTION

- 3.1 EXCAVATION FOR PIPE CULVERTS AND STORM DRAINS
 - 3.1.1 Trenching
 - 3.1.2 Removal of Unstable Material
- 3.2 BEDDING
 - 3.2.1 Corrugated Metal Pipe
- 3.3 PLACING PIPE
 - 3.3.1 Corrugated Metal Pipe and Pipe Arch
- 3.4 JOINTING
 - 3.4.1 Corrugated Metal Pipe
 - 3.4.1.1 Field Joints
 - 3.4.1.2 Flexible Watertight, Gasketed Joints
- 3.5 BACKFILLING
 - 3.5.1 Backfilling Pipe in Trenches
 - 3.5.2 Movement of Construction Machinery
 - 3.5.3 Compaction
- 3.6 PIPELINE TESTING

-- End of Section Table of Contents --

SECTION 02630

STORM-DRAINAGE SYSTEM

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 346/346R (1990) Standard Specification for
Cast-in-Place Nonreinforced Concrete Pipe
and Recommendations

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO HB-16 (1996) Standard Specifications for Highway
Bridges

AASHTO M 167 (1994) Corrugated Steel Structural Plate,
Zinc Coated, for Field Bolted Pipe

AASHTO M 190 (1995) Bituminous Coated Corrugated Metal
Culvert Pipe and Pipe Arches

AASHTO M 198 (1998) Joints for Circular Concrete Sewer
and Culvert Pipe Using Flexible Watertight
Gaskets

AASHTO M 219 (1992; R 1995) Aluminum Alloy Structural
Plate for Field Bolted Conduits

AASHTO M 243 (1996) Field Applied Coating of Corrugated
Metal Structural Plate for Pipe,
Pipe-Arches, and Arches

AASHTO M 294 (1998) Corrugated Polyethylene Pipe, 300-
to 1200- mm Diameter

AASHTO MP7 (1997) Corrugated Polyethylene Pipe, 1350
and 1500 mm Diameter

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION
(AREMA)

AREMA Manual (1999) Manual for Railway Engineering (4 Vol.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994a) Gray Iron Castings
ASTM A 48M	(1994 el) Gray Iron Castings (Metric)
ASTM A 123/A 123M	(1997ael) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 536	(1999el) Ductile Iron Castings
ASTM A 716	(1995) Ductile Iron Culvert Pipe
ASTM A 742/A 742M	(1998) Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe
ASTM A 760/A 760M	(1997) Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM A 762/A 762M	(1998) Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A 798/A 798M	(1997a) Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
ASTM A 807	(1997) Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications
ASTM A 849	(1997) Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
ASTM A 929/A 929M	(1997) Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
ASTM B 26/B 26M	(1998) Aluminum-Alloy Sand Castings
ASTM B 745/B 745M	(1997) Corrugated Aluminum Pipe for Sewers and Drains
ASTM C 12	(1998el) Installing Vitrified Clay Pipe Lines
ASTM C 14	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 14M	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)

ASTM C 32	(1999e1) Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C 55	(1999) Concrete Brick
ASTM C 62	(1997a) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 76	(1999) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 76M	(1999a) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 139	(1999) Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(1997) Mortar for Unit Masonry
ASTM C 425	(1998b) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 443M	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric)
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C 506	(1999) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C 506M	(1999) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 507	(1999) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
ASTM C 507M	(1999) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 655	(1995a) Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe

ASTM C 700	(1999) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 789	(1998) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
ASTM C 828	(1998) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 850	(1998) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 ft. of Cover Subjected to Highway Loadings
ASTM C 877	(1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 877M	(1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
ASTM C 923	(1998) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Materials
ASTM C 924	(1998) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 924M	(1998) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method (Metric)
ASTM C 1103	(1994) Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 1103M	(1994) Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)
ASTM D 1056	(1998) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1171	(1994) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 1751	(1999) Preformed Expansion Joint Filler

	for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2321	(1989; R 1995) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3034	(1998) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3350	(1998a) Polyethylene Plastics Pipe and Fittings Materials
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 679	(1995) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F 714	(1997) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F 794	(1999) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 894	(1998a) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F 949	(1999) Poly(Vinyl Chloride) (PVC)

Corrugated Sewer Pipe with a Smooth
Interior and Fittings

ASTM F 1417

(1992; R 1998) Installation Acceptance of
Plastic Gravity Sewer Lines Using
Low-Pressure Air

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Data; FIO.

Printed copies of the manufacturer's data for pipe and joints.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Corrugated Steel Pipe

ASTM A 760/A 760M, zinc or aluminum (Type 2) coated pipe of:

- a. Type II pipe with helical 2-2/3 by 1/2 inch corrugations.

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A 929/A 929M.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Joints

2.3.1.1 Flexible Watertight, Gasketed Joints

- a. Gaskets: When infiltration or exfiltration is a concern for pipe lines, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band approximately 7 inches wide and approximately 3/8 inch thick, meeting the requirements of ASTM D 1056, Type 2, and shall have a quality retention rating of not less than 70 percent when tested for weather resistance by ozone chamber exposure, Method B of ASTM D 1171. Rubber O-ring gaskets shall be 13/16 inch in diameter for pipe diameters of 36 inches or smaller and 7/8 inch in diameter for larger pipe having 1/2 inch deep end corrugation. Rubber O-ring gaskets shall be 1-3/8 inches in diameter for pipe having 1 inch deep end corrugations. O-rings shall meet the requirements of AASHTO M 198 or ASTM C 443. Flexible plastic gaskets shall conform to requirements of AASHTO M 198, Type B.
- b. Connecting Bands: Connecting bands shall be of the type, size and sheet thickness of band, and the size of angles, bolts, rods and lugs as indicated or where not indicated as specified in the applicable standards or specifications for the pipe. Exterior rivet heads in the longitudinal seam under the connecting band shall be countersunk or the rivets shall be omitted and the seam welded.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS AND STORM DRAINS

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 02300 "Earthwork" and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 18 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheet piling and bracing, where required, shall be placed within the trench width as specified. Contractor shall not overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary.

Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered

in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Corrugated Metal Pipe

Bedding for corrugated metal pipe and pipe arch shall be in accordance with ASTM A 798/A 798M. It is not required to shape the bedding to the pipe geometry. However, for pipe arches, the Contractor shall either shape the bedding to the relatively flat bottom arc or fine grade the foundation to a shallow v-shape. Bedding for corrugated structural plate pipe shall meet requirements of ASTM A 807.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Corrugated Steel and Aluminum Alloy	5

Not less than 30 days after the completion of backfilling, the Contracting Officer may perform a deflection test on the entire length of installed flexible pipe using a mandrel or other suitable device. Installed flexible pipe showing deflections greater than those indicated above shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

3.3.1 Corrugated Metal Pipe and Pipe Arch

Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Part paved pipe shall be installed so that

the centerline of bituminous pavement in the pipe, indicated by suitable markings on the top at each end of the pipe sections, coincides with the specified alignment of pipe. Fully paved steel pipe or pipe arch shall have a painted or otherwise applied label inside the pipe or pipe arch indicating sheet thickness of pipe or pipe arch. Any unprotected metal in the joints shall be coated with bituminous material as specified in AASHTO M 190 or AASHTO M 243. Interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During transportation and installation, pipe or pipe arch and coupling bands shall be handled with care to preclude damage to the coating, paving or lining. Damaged coatings, pavings and linings shall be repaired in accordance with the manufacturer's recommendations prior to placing backfill. Pipe on which coating, paving or lining has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced. Vertical elongation, where indicated, shall be accomplished by factory elongation. Suitable markings or properly placed lifting lugs shall be provided to ensure placement of factory elongated pipe in a vertical plane.

3.4 JOINTING

3.4.1 Corrugated Metal Pipe

3.4.1.1 Field Joints

Transverse field joints shall be designed so that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A 798/A 798M. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. The annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 30 inches or larger, shall be filled with a bituminous material after jointing. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

3.4.1.2 Flexible Watertight, Gasketed Joints

Installation shall be as recommended by the gasket manufacturer for use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same

pipe. When the adjoining section of pipe is in place, the doubled-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so that the gasket covers the end of pipe sections equally. Connecting bands shall be centered over adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. Band Tightening: The band shall be tightened evenly, even tension being kept on the rods or bolts, and the gasket; the gasket shall seat properly in the corrugations. Watertight joints shall remain uncovered for a period of time designated, and before being covered, tightness of the nuts shall be measured with a torque wrench. If the nut has tended to loosen its grip on the bolts or rods, the nut shall be retightened with a torque wrench and remain uncovered until a tight, permanent joint is assured.

3.5 BACKFILLING

3.5.1 Backfilling Pipe in Trenches

(Refer to Section 02300, 3.8.1)

3.5.2 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.5.3 Compaction

(Refer to Section 02300, 3.10.1)

3.6 PIPELINE TESTING

Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate. Low pressure air testing for concrete pipes shall conform to ASTM C 924. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C 828 or ASTM C 924, after consultation with the pipe manufacturer.

Testing of individual joints for leakage by low pressure air or water shall conform to ASTM C 1103. Prior to exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection.

Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established. The amount of water required

to maintain this water level during a 2-hour test period shall be measured.

Leakage as measured by the exfiltration test shall not exceed 0.2 gallons per inch in diameter per 100 feet of pipeline per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correcting, and retesting shall be made at no additional cost to the Government.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02705

PAVING AND RESURFACING

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUMMARY
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
- 1.5 REGULATORY REQUIREMENTS

PART 2 PRODUCTS

- 2.1 PAVING MATERIALS
- 2.2 HEADERS
- 2.3 PAVEMENT PAINT

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 PAVEMENT CUTTING
- 3.3 PLACEMENT OF AGGREGATE BASE
- 3.4 ASPHALT CONCRETE INSTALLATION
- 3.5 ASPHALT CONCRETE TESTING
- 3.6 PAVEMENT MARKINGS
- 3.7 HEADERS

-- End of Section Table of Contents --

SECTION 02705

PAVING AND RESURFACING
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

Whenever the words "Standard Specifications" are referred to, the reference is to the State of California, Department of Transportation, Standard Specifications.

American Society for Testing and Materials (ASTM)

ASTM D 1556	Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2922	Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Method (Shallow Depth)

1.2 SUMMARY

A. Section Includes: Furnishing all labor, material, equipment, tools and services required for the placing and compacting of asphalt concrete pavement and aggregate surfacing for roadways, parking lots and walkways to the lines, grades and dimensions shown on the Drawings and as specified herein. Also included is the repair and resurfacing of existing roadway and area paving damaged or removed during construction.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Mix Certificate; FIO.

Submit a batch plant mix certificate from each source of supply for each construction material employed on this project indicating that the materials meet the Specification requirements.

1.4 QUALITY ASSURANCE

Comply with "Standard Specifications" of State of California, Department of Transportation (CALTRANS).

1.5 REGULATORY REQUIREMENTS

All work, material, procedures and practices under this Section shall conform with requirements of the California Air Resources Board (CARB) and the Air Pollution Control District having jurisdiction.

PART 2 PRODUCTS

2.1 PAVING MATERIALS

A. Aggregate Base: Standard Specifications, Section 26. Class and size as indicated on the Drawings; or if not indicated on the Drawings, use Class 2, 3/4-inch maximum.

B. Tack Coat and Seal Coat: Emulsified asphalt, Grade SS-1 or SS-1h, Standard Specifications, Section 94.

C. Asphalt Concrete: Type B, 1/2-inch maximum, medium grading, Standard Specification Section 39. Bitumin ratio shall be selected by the supplier in accordance with paragraph 39-2.02 of the Standard Specifications.

2.2 HEADERS

A. At straight sections, wood headers shall be constructed of 2-inch x 6-inch construction heart redwood, held in place by 2-inch x 4-inch stakes, of the same materials, 2 feet long and set at 8-foot centers.

B. At curved sections, wood headers shall be constructed of three 1/2-inch x 4-inch construction heart redwood bender boards. Boards shall be lapped at one-third of the length of individual boards, with no two boards lapped at the same place. Hold boards in place with stakes same as above.

2.3 PAVEMENT PAINT

Comply with Section 84-3.02 of the Standard Specifications.

PART 3 EXECUTION

3.1 GENERAL

A. This Specification shall cover newly surfaced areas as well as restoration of existing surfacing.

- B. Adjust existing and new manholes, meter boxes, cleanouts, etc. to match the new grade.

3.2 PAVEMENT CUTTING

After backfilling trenches and prior to paving, saw cut existing pavement parallel to the trench (using a concrete saw) to a minimum depth equal to or greater than one-half the thickness thereof. The pavement shall be cut back 6 inches on each side of the trench or excavation wall. Re-cut and restore any pavement damaged outside these lines at the expense of the Contractor. Should voids develop under the existing pavements during construction, those affected pavements shall be neatly saw cut in straight lines and replaced after the voids have been filled.

3.3 PLACEMENT OF AGGREGATE BASE

- A. Subgrade Preparation: Water or dry subgrade as required to bring the soil to at least 3% above the optimum moisture content for proper compacting. Compact to a relative compaction of not less than 95% in the upper 6 inches. When compaction of the subgrade areas on fill and embankments has been properly obtained, only such additional rolling will be required as necessary to obtain a thoroughly compacted subgrade immediately prior to placing the aggregate base thereon.
- B. Aggregate Base Tolerance: Do not place the aggregate base before the subgrade is approved by the Contracting Officer. The finished aggregate base shall not vary more than 0.05 foot above, nor 0.10 foot below, the planned grade.
- C. Aggregate Base Placing: Spread the aggregate base material on the prepared subgrade by means of suitable spreading devices. The aggregate base material may be dumped in piles upon the subgrade and spread by bulldozing ahead from the dumped material. Each layer shall not exceed 0.50 feet. Segregation of large or fine particles of aggregate shall be avoided, and the material as spread shall be free from pockets of large and fine material.
- D. Compaction: Laboratory maximum density and optimum moisture shall be determined by ASTM D 1557, Method C. Compact each layer of aggregate base material to not less than 98% relative compaction as determined by ASTM D 1556 (Sand Cone), or ASTM D 2922 (Nuclear method when approved by the Contracting Officer). Compaction shall be in accordance with Section 26-1.05 of the Standard Specifications. Water aggregate base after compaction as provided in Section 17 of the Standard Specifications. Paragraph 17-1.04 is not applicable.

3.4 ASPHALT CONCRETE INSTALLATION

- A. Apply tack coat at a rate of 0.05-gallon per square yard and apply along vertical edge of cut pavement.
- B. Spread and compact asphalt concrete in accordance with Standard Specifications Section 39 to the thickness shown on the Drawings. Asphalt concrete shall be compacted to not less than 95% of the laboratory maximum

density.

C. Protect asphaltic concrete paving until surface has cooled sufficiently to permit traffic without damage.

D. Immediately remove spilled and splattered materials from adjacent surfaces.

3.5 ASPHALT CONCRETE TESTING

The Contractor is responsible for asphalt concrete testing. Requirements of testing shall be in accordance with Construction Control Manual (CESPK PAM 415-1-2).

3.6 PAVEMENT MARKINGS

A. Replace existing pavement markings that are removed or damaged by the construction.

B. Apply pavement markings in accordance with Section 84 of the Standard Specifications.

3.7 HEADERS

Install wood headers along pavement edges where indicated on the Drawings. Install new headers where existing wood headers are damaged during construction, or removed for construction. Install headers with uniform slope between spot elevation indicated on the Drawings or to conform to existing grades.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02821

FENCING

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS

PART 2 PRODUCTS

- 2.1 FENCE FABRIC
 - 2.1.1 Chain Link Fence Fabric
- 2.2 GATES
- 2.3 POSTS
 - 2.3.1 Metal Posts for Chain Link Fence
- 2.4 BRACES AND RAILS
- 2.5 WIRE
 - 2.5.1 Tension Wire
 - 2.5.2 Barbed Wire
 - 2.5.3 Tie Wire
- 2.6 ACCESSORIES
- 2.7 SLATS
- 2.8 CONCRETE
- 2.9 PADLOCKS

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 EXCAVATION
- 3.3 POST INSTALLATION
 - 3.3.1 Posts for Chain Link Fence
- 3.4 RAILS
 - 3.4.1 Top Rail
 - 3.4.2 Bottom Rail
- 3.5 BRACES AND TRUSS RODS
- 3.6 TENSION WIRES
- 3.7 CHAIN LINK FABRIC
- 3.8 BARBED WIRE SUPPORTING ARMS AND BARBED WIRE
 - 3.8.1 General Requirements
- 3.9 GATE INSTALLATION
- 3.10 GROUNDING

-- End of Section Table of Contents --

SECTION 02821

FENCING

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	Specification for Pipe, Steel Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 116	(1995) Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
ASTM A 121	(1992a) Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A 153/A 153M	(1998) Zinc-Coated (Hot Dip) on Iron and Steel Hardware
ASTM A 176	(1997) Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
ASTM A 392	(1996) Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A 478	(1997) Chromium-Nickel Stainless and Heat-Resisting Steel Weaving and Knitting Wire
ASTM A 491	(1996) Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A 585	(1997) Aluminum-Coated Steel Barbed Wire
ASTM A 666	(1996b) Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
ASTM A 702	(1989; R 1994) Steel Fence Posts and Assemblies, Hot Wrought

ASTM A 780	(1993a) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM A 824	(1995) Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence
ASTM C 94	(1998) Ready-Mixed Concrete
ASTM D 4541	(1995) Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM F 626	(1996) Fence Fittings
ASTM F 668	(1996) Poly(Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric
ASTM F 883	(1997) Padlocks
ASTM F 900	(1994) Industrial and Commercial Swing Gates
ASTM F 1043	(1998a) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework
ASTM F 1083	(1997) Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F 1184	(1994) Industrial and Commercial Horizontal Slide Gates
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM G 26	(1996) Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM G 53	(1996) Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-1 Data

Chain Link Fence; FIO.

Submit complete descriptive information and technical specifications on the chain link fence, gates, and appurtenances.

PART 2 PRODUCTS

2.1 FENCE FABRIC

Fence fabric shall conform to the following:

2.1.1 Chain Link Fence Fabric

ASTM A 392, Class 1, zinc-coated steel wire with minimum coating weight of 1.2 ounces of zinc per square foot of coated surface. Fabric shall be fabricated of 9 gauge wire woven in 2 inch mesh. Fabric height shall be 6 feet. Fabric shall be twisted and barbed on the top selvage and knuckled on the bottom selvage.

2.2 GATES

Gates shall be installed in the sizes and at the locations as shown on the Drawings.

Swinging Gates: ASTM F 900 and/or ASTM F 1184. Gate frames shall conform to strength and coating requirements of ASTM F 1083 for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2. Gate frames shall conform to strength and coating requirements of ASTM F 1043, for Group IC, steel pipe with external coating Type A or Type B, nominal pipe size (NPS) 1-1/2. Gate fabric shall be as specified for chain link fabric. Gate leaves more than 8 feet wide shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 8 feet wide shall have truss rods or intermediate braces. Intermediate braces shall be provided on all gate frames with an electro-mechanical lock. Gate fabric shall be attached to the gate frame by method standard with the manufacturer except that welding will not be permitted. Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gate. Latches shall be arranged for padlocking so that the padlock will be accessible from both sides of the gate. Stops shall be provided for holding the gates in the open position. For high security applications, each end member of gate frames shall be extended sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence.

Rolling Gates: All gate frames shall have 1-inch Schedule 40 steel pipe diagonal braces inside each gate panel. Diagonal braces shall be installed such that the high end of the braces shall be toward the forward end of the gate as the gate rolls closed (i.e., high end of the braces toward the end of the gate that rolls on the ground and low end of the braces toward the end of the gate that is supported on the adjacent stationary fence). Gates shall have two wheels that travel on two 1-1/4-inch-diameter Schedule 40 galvanized steel pipe guide rails attached to the adjacent stationary fence. These rails shall have stops to prevent the gate wheels from

rolling off the back end of the rails when the gate is fully opened. The opposite end of the gate shall have two 8-inch rubber wheels on grade.

2.3 POSTS

2.3.1 Metal Posts for Chain Link Fence

ASTM F 1083, zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or Type B and Group II, formed steel sections, shall meet the strength and coating requirements of ASTM F 1043. Group III, ASTM F 1043 steel H-section may be used for line posts in lieu of line post shapes specified for the other classes. Sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate post shall be for the gate type specified subject to the limitation specified in ASTM F 900 and/or ASTM F 1184.

2.4 BRACES AND RAILS

ASTM F 1083, zinc-coated, Group IA, steel pipe, size NPS 1-1/4. Group IC steel pipe, zinc-coated, shall meet the strength and coating requirements of ASTM F 1043. Group II, formed steel sections, size 1-21/32 inch, conforming to ASTM F 1043, may be used as braces and rails if Group II line posts are furnished.

2.5 WIRE

2.5.1 Tension Wire

Tension wire shall be Type I or Type II, Class 2 coating, in accordance with ASTM A 824.

2.5.2 Barbed Wire

Barbed wire shall be 2 strand, 12-1/2 gauge wire, zinc-coated, Class 3 in accordance with ASTM A 121 or aluminum coated Type I in accordance with ASTM A 585. Barbed wire shall be four-point barbed type steel wire. Barbed wire support arms shall be the V arm type and of the design required for the post furnished.

2.5.3 Tie Wire

Tie wire for attaching fabric to rails, braces, and posts shall be 9 gauge steel wire and match the coating of the fence fabric. Miscellaneous hardware coatings shall conform to ASTM A 153/A 153M unless modified.

2.6 ACCESSORIES

ASTM F 626. Ferrous accessories shall be zinc or aluminum coated. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment.

2.7 SLATS

Slats shall be high density polyethylene containing color pigmentation and U.V. inhibitors to resist the effects of ultra violet radiation from sunlight. Slats shall be installed in the chain link fabric wire where shown on the Drawings. Slats shall be in lengths to equal the fence height.

2.8 CONCRETE

ASTM C 94, using 3/4 inch maximum size aggregate, and having minimum compressive strength of 3000 psi at 28 days. Grout shall consist of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

2.9 PADLOCKS

Padlocks shall conform to ASTM F 883, Type P01, Option A , Size 1-3/4 inch. Provide total of three padlocks for the project. All padlocks shall be keyed alike. The padlocks will be installed at the gates of the water treatment plant.

PART 3 EXECUTION

3.1 INSTALLATION

Fence shall be installed to the lines and grades indicated. The area on either side of the fence line shall be cleared to the extent indicated. Line posts shall be spaced equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 500 feet. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A 780.

3.2 EXCAVATION

Post holes shall be cleared of loose material. Waste material shall be spread where directed. The ground surface irregularities along the fence line shall be eliminated to the extent necessary to maintain a 1 inch clearance between the bottom of the fabric and finish grade.

3.3 POST INSTALLATION

3.3.1 Posts for Chain Link Fence

Posts shall be set plumb and in alignment. Except where solid rock is encountered, posts shall be set in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, posts shall be set to a minimum depth of 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, posts shall be set to the minimum depth indicated on the drawing unless a penetration of 18 inches in solid rock is achieved before reaching the indicated depth, in which case depth of penetration shall terminate. All portions of posts set in rock shall be grouted. Portions of posts not set in rock shall be set in concrete from the rock to ground level. Posts set in concrete shall be set

in holes not less than the diameter shown on the drawings. Diameters of holes in solid rock shall be at least 1 inch greater than the largest cross section of the post. Concrete and grout shall be thoroughly consolidated around each post, shall be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure for 72 hours prior to attachment of any item to the posts. Group II line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Driven posts shall be set to a minimum depth of 3 feet and shall be protected with drive caps when being set. For high security fences, fence post rigidity shall be tested by applying a 50 pound force on the post, perpendicular to the fabric, at 5 feet above ground; post movement measured at the point where the force is applied shall be less than or equal to 3/4 inch from the relaxed position; every tenth post shall be tested for rigidity; when a post fails this test, further tests on the next four posts on either side of the failed post shall be made; all failed posts shall be removed, replaced, and retested at the Contractor's expense.

3.4 RAILS

3.4.1 Top Rail

Top rail shall be supported at each post to form a continuous brace between terminal posts. Where required, sections of top rail shall be joined using sleeves or couplings that will allow expansion or contraction of the rail. Top rail, if required for high security fence, shall be installed as indicated on the drawings.

3.4.2 Bottom Rail

The bottom rail shall be bolted to double rail ends and double rail ends shall be securely fastened to the posts. Bolts shall be peened to prevent easy removal. Bottom rail shall be installed before chain link fabric.

3.5 BRACES AND TRUSS RODS

Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal (compression) braces and diagonal truss (tension) rods shall be installed on fences over 6 feet in height. A center brace or 2 diagonal truss rods shall be installed on 12 foot fences. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal. No bracing is required on fences 6 feet high or less if a top rail is installed.

3.6 TENSION WIRES

Tension wires shall be installed along the top and bottom of the fence line and attached to the terminal posts of each stretch of the fence. Top tension wires shall be installed within the top 4 inches of the installed fabric. Bottom tension wire shall be installed within the bottom 6 inches of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

3.7 CHAIN LINK FABRIC

Chain link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15 inch intervals. The fabric shall be installed and pulled taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fabric shall be fastened to line posts at approximately 15 inch intervals and fastened to all rails and tension wires at approximately 24 inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be 1 plus or minus 1/2 inch above the ground. For high security fence, after the fabric installation is complete, the fabric shall be exercised by applying a 50 pound push-pull force at the center of the fabric between posts; the use of a 30 pound pull at the center of the panel shall cause fabric deflection of not more than 2-1/2 inches when pulling fabric from the post side of the fence; every second fence panel shall meet this requirement; all failed panels shall be resecured and retested at the Contractor's expense.

3.8 BARBED WIRE SUPPORTING ARMS AND BARBED WIRE

3.8.1 General Requirements

Barbed wire supporting arms and barbed wire shall be installed as indicated and as recommended by the manufacturer. Supporting arms shall be anchored to the posts in a manner to prevent easy removal with hand tools. Barbed wire shall be pulled taut and attached to the arms with clips or other means that will prevent easy removal.

3.9 GATE INSTALLATION

Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Rolling gates shall be installed as recommended by the manufacturer. Padlocks shall be attached to gates or gate posts with chains. Hinge pins, and hardware shall be welded or otherwise secured to prevent removal.

3.10 GROUNDING

Fences shall be grounded on each side of all gates, at each corner, at the closest approach to each building located within 50 feet of the fence, and where the fence alignment changes more than 15 degrees. Grounding locations shall not exceed 650 feet. Each gate panel shall be bonded with a flexible bond strap to its gate post. Fences crossed by powerlines of 600 volts or more shall be grounded at or near the point of crossing and at distances not exceeding 150 feet on each side of crossing. Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be 3/4 inch by 10 foot long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable, electrodes shall be buried a minimum of 12 inches deep and radially from

the fence. The top of the electrode shall be not less than 2 feet or more than 8 feet from the fence. Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. After installation the total resistance of fence to ground shall not be greater than 25 ohms.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02930

EXTERIOR PLANTING

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 SOURCE INSPECTIONS
- 1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING
 - 1.4.1 Delivery
 - 1.4.1.1 Plant Material Identification
 - 1.4.1.2 Protection During Delivery
 - 1.4.1.3 Delivered Topsoil
 - 1.4.1.4 Soil Amendments
 - 1.4.2 Inspection
 - 1.4.3 Storage
 - 1.4.3.1 Plant Material Storage
 - 1.4.3.2 Other Material Storage
 - 1.4.4 Handling
 - 1.4.5 Time Limitation
- 1.5 WARRANTY

PART 2 PRODUCTS

- 2.1 PLANT MATERIAL
 - 2.1.1 Plant Material Classification
 - 2.1.2 Plant Schedule
 - 2.1.3 Substitutions
 - 2.1.4 Quality
 - 2.1.5 Growing Conditions
 - 2.1.6 Method of Shipment to Maintain Health of Root System
 - 2.1.6.1 Balled and Burlapped (BB) Plant Material
 - 2.1.6.2 Balled and Potted (Pot) Plant Material
 - 2.1.6.3 Balled and Platform (BP) Plant Material
 - 2.1.6.4 Bare-Root (BR) Plant Material
 - 2.1.6.5 Container-Grown (C) Plant Material
 - 2.1.7 Growth of Trunk and Crown
 - 2.1.7.1 Deciduous Trees
 - 2.1.7.2 Coniferous Evergreen Plant Material
 - 2.1.8 Plant Material Size
- 2.2 TOPSOIL
- 2.3 SOIL AMENDMENTS
 - 2.3.1 Fertilizer
- 2.4 MULCH

- 2.4.1 Organic Mulch
 - 2.4.1.1 Recycled Mulch
 - 2.4.1.2 Shredded Bark
 - 2.4.1.3 Wood Chips and Ground Bark
- 2.5 GEOTEXTILE
- 2.6 WOOD STAKING MATERIAL
 - 2.6.1 Bracing Stake
- 2.7 TREE ROOT BARRIERS

PART 3 EXECUTION

- 3.1 SITE PREPARATION
 - 3.1.1 Finished Grade, Topsoil and Underground Utilities
 - 3.1.2 Layout
 - 3.1.3 Protecting Existing Vegetation
- 3.2 EXCAVATION
 - 3.2.1 Obstructions Below Ground
 - 3.2.2 Turf Removal
 - 3.2.3 Plant Pits
- 3.3 INSTALLATION
 - 3.3.1 Setting Plant Material
 - 3.3.1.1 Bare-Root Plant Material
 - 3.3.2 Tree Root Barrier
 - 3.3.3 Backfill Soil Mixture
 - 3.3.4 Backfill Procedure
 - 3.3.4.1 Balled and Burlapped, and Balled and Platformed Plant Material
 - 3.3.4.2 Bare-Root Plant Material
 - 3.3.4.3 Container-Grown and Balled and Potted Plant Material
 - 3.3.4.4 Earth Berm
 - 3.3.5 Plant Bed
 - 3.3.6 Watering
 - 3.3.7 Staking and Guying
 - 3.3.7.1 One Bracing Stake
 - 3.3.7.2 Two Bracing Stakes
- 3.4 FINISHING
 - 3.4.1 Plant Material
 - 3.4.2 Placing Geotextile
 - 3.4.3 Placing Mulch
 - 3.4.4 Pruning
- 3.5 MAINTENANCE DURING PLANTING OPERATION
- 3.6 RESTORATION AND CLEAN UP
 - 3.6.1 Restoration
 - 3.6.2 Clean Up

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 02930

EXTERIOR PLANTING

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)

ANLA ANSI/ANLA Z60.1 (1996) Nursery Stock

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300 (1995) Tree Care Operations - Trees, Shrubs and other Woody Plant Maintenance

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602 (1995a) Agricultural Liming Materials

ASTM D 4972 (1995a) pH of Soils

ASTM D 5034 (1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)

ASTM D 5035 (1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)

ASTM D 5268 (1992; R1996) Topsoil Used for Landscaping Purposes

ASTM D 5883 (1996) Standard Guide for Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Soil Test Data: FIO

Submit soil test for delivered topsoil.

SD-13 Certificates

Source Quality Control; FIO

Submit written certifications stating all amendments, top soil conform to the specification requirements.

1.3 SOURCE INSPECTIONS

The nursery or source of plant material and the source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.4.1.1 Plant Material Identification

Plant material shall be identified with attached, durable, waterproof labels and weather-resistant ink, stating the correct botanical plant name and size.

1.4.1.2 Protection During Delivery

Plant material shall be protected during delivery to prevent desiccation and damage to the branches, trunk, root system, or earth ball. Branches shall be protected by tying-in. Exposed branches shall be covered during transport.

1.4.1.3 Delivered Topsoil

Prior to the delivery of any topsoil, the availability of topsoil shall be verified in paragraph TOPSOIL. A soil test shall be provided for delivered topsoil.

1.4.1.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis.

1.4.2 Inspection

Plant material shall be well shaped, vigorous and healthy with a healthy, well branched root system, free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement or abrasion. Plant material shall be

checked for unauthorized substitution and to establish nursery grown status. Plant material showing desiccation, abrasion, sun-scald injury, disfigurement, or unauthorized substitution shall be rejected. The plant material shall exhibit typical form of branch to height ratio; and meet the caliper and height measurements specified. Plant material that measures less than specified, or has been poled, topped off or headed back, shall be rejected. Container-grown plant material shall show new fibrous roots and the root mass shall contain its shape when removed from the container. Plant material with broken or cracked balls; or broken containers shall be rejected. Bare-root plant material that is not dormant or is showing roots were pulled from the ground shall be rejected. Other materials shall be inspected for compliance with paragraph PRODUCTS. Open soil amendment containers or wet soil amendments shall be rejected. Topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material larger than 1-1/2 inch diameter shall be rejected. Topsoil that contains viable plant material and plant parts shall be rejected. Unacceptable material shall be removed from the job site.

1.4.3 Storage

1.4.3.1 Plant Material Storage

Plant material not installed on the day of arrival at the site shall be stored and protected in designated areas. Plant material shall not be stored longer than 30 days. Plant material shall be protected from direct exposure to wind and sun. Bare-root plant material shall be heeled-in. All plant material shall be kept in a moist condition by watering with a fine mist spray until installed.

1.4.3.2 Other Material Storage

Storage of other material shall be in designated areas. Soil amendments shall be stored in dry locations and away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with planting operation material.

1.4.4 Handling

Plant material shall not be injured in handling. Cracking or breaking the earth ball of balled and burlapped plant material shall be avoided. Plant material shall not be handled by the trunk or stems. Materials shall not be dropped from vehicles.

1.4.5 Time Limitation

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum 24 hours.

1.5 WARRANTY

Trees in 15-gallon can or larger shall be in thriving condition 1 year from the date of final acceptance, shrubs for 6 months from date of acceptance.

Plant maintenance shall be for 60 days from the date of acceptance. Ground cover and shrub areas shall be weeded and dead plants replaced at 30 day intervals for 60 days.

PART 2 PRODUCTS

2.1 PLANT MATERIAL

2.1.1 Plant Material Classification

The plant material shall be nursery grown stock conforming to ANLA ANSI/ANLA Z60.1 and shall be the species specified.

2.1.2 Plant Schedule

The plant schedule shall provide botanical names as included in one or more of the publications listed under "Nomenclature" in ANLA ANSI/ANLA Z60.1.

2.1.3 Substitutions

Substitutions will not be permitted without written request and approval from the Contracting Officer.

2.1.4 Quality

Well shaped, well grown, vigorous plant material having healthy and well branched root systems in accordance with ANLA ANSI/ANLA Z60.1 shall be provided. Plant material shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems, which may occur from the digging and preparation for shipment, method of shipment, or shipment. Plant quality is determined by the growing conditions; method of shipment to maintain health of the root system; and growth of the trunk and crown as follows.

2.1.5 Growing Conditions

Plant material shall be native to or well-suited to the growing conditions of the project site. Plant material shall be grown under climatic conditions similar to those at the project site.

2.1.6 Method of Shipment to Maintain Health of Root System

2.1.6.1 Balled and Burlapped (BB) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with biodegradable twine.

2.1.6.2 Balled and Potted (Pot) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be done by hand digging or mechanical devices. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. Container shall be used to retain the ball unbroken. Container shall be rigid to hold ball shape and protect root mass during shipping.

2.1.6.3 Balled and Platform (BP) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. Plants shall be prepared as balled and burlapped plant material and securely fastened to wood platform for shipping.

2.1.6.4 Bare-Root (BR) Plant Material

Minimum root spread shall be in accordance with ANLA ANSI/ANLA Z60.1. A well branched root system characteristic of the species specified shall be provided. Roots shall not be pulled from the ground. Bare-root plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. Bare-root plant material shall be dormant. The root system shall be protected from drying out.

2.1.6.5 Container-Grown (C) Plant Material

Container size shall be in accordance with ANLA ANSI/ANLA Z60.1. Plant material shall be grown in a container over a duration of time for new fibrous roots to have developed and for the root mass to retain its shape and hold together when removed from the container. Container-grown plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. The container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

2.1.7 Growth of Trunk and Crown

2.1.7.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANLA ANSI/ANLA Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

- a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
- b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no

division of the trunk which branches more than 6 inches from ground level.

- c. Specimen: The tree provided shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

2.1.7.2 Coniferous Evergreen Plant Material

Coniferous Evergreen plant material shall have the height-to-spread ratio recommended by ANLA ANSI/ANLA Z60.1. The coniferous evergreen trees shall not be "poled" or the leader removed. Acceptable plant material shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

2.1.8 Plant Material Size

Plant material shall be furnished in sizes indicated. Plant material larger in size than specified may be provided at no additional cost to the Government.

2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300 EARTHWORK. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the plant material specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

2.3 SOIL AMENDMENTS

2.3.1 Fertilizer

Fertilizer shall be controlled release commercial grade; free flowing, pellet or tablet form; uniform in composition; and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. Rotted manure is not recommended to be used as a mulch because it would encourage surface rooting of the plant material and weeds.

2.4.1 Organic Mulch

Organic mulch materials shall be native to the project site and consist of recycled mulch, shredded bark, wood chips, or ground bark.

2.4.1.1 Recycled Mulch

Recycled mulch may include compost, tree trimmings, or pine needles with a gradation that passes through a 2-1/2 x 2-1/2 inch screen. It shall be cleaned of all sticks a minimum 1 inch in diameter and plastic materials a minimum 3 inch length. The material shall be treated to retard the growth of mold and fungi. Other recycled mulch may include peanut shells, pecan shells or coco bean shells.

2.4.1.2 Shredded Bark

Locally shredded material shall be treated to retard the growth of mold and fungi.

2.4.1.3 Wood Chips and Ground Bark

Locally chipped or ground material shall be treated to retard the growth of mold and fungi. Gradation: A maximum 2 inch wide by 4 inch long.

2.5 GEOTEXTILE

Geotextile shall be woven or nonwoven; polypropylene, polyester, or fiberglass, mat in accordance with ASTM D 5034 or ASTM D 5035. It shall be made specifically for use as a fabric around plant material. Nominal weight shall be a minimum 4 ounces per square yard. Permeability rate shall be a minimum 0.04 inch per second.

2.6 WOOD STAKING MATERIAL

Wood stakes shall be lodge pole pine; rough sawn; free from knots, rot, cross grain, or other defects that would impair their strength.

2.6.1 Bracing Stake

Wood tree stakes to be lodge pole pine stakes, full length treated with copper naphthanate. Minimum nominal size to be two inches in diameter by eight feet long and pointed at one end. Stakes shall be free from knots, checks, splits, or disfigurements.

2.7 TREE ROOT BARRIERS

Tree root barriers shall be metal or plastic consisting of recycled content. Barriers shall utilize vertical stabilizing members to encourage downward tree root growth. Barriers shall limit, by a minimum 90 percent, the occurrence of surface roots. Tree root barriers which are designed to be used as plant pit liners will be rejected.

PART 3 EXECUTION

3.1 SITE PREPARATION

3.1.1 Finished Grade, Topsoil and Underground Utilities

The Contractor shall verify that finished grades are as indicated on drawings, and that the placing of topsoil, the smooth grading, and the compaction requirements have been completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the planting operation. The location of underground utilities and facilities in the area of the planting operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.1.2 Layout

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted to meet field conditions.

3.1.3 Protecting Existing Vegetation

When there are established lawns in the planting area, the turf shall be covered and/or protected during planting operations. Existing trees, shrubs, and plant beds that are to be preserved shall be barricaded along the dripline to protect them during planting operations.

3.2 EXCAVATION

3.2.1 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments to plant material location, type of plant and planting method shall be submitted for approval.

3.2.2 Turf Removal

Where the planting operation occurs in an existing lawn area, the turf shall be removed from the excavation area to a depth that will ensure the removal of the entire root system.

3.2.3 Plant Pits

Plant pits shall be dug with level bottoms and square sides. Width and depth of pit for plants shall be in accordance with the detail drawings.

3.3 INSTALLATION

3.3.1 Setting Plant Material

Plant material shall be set plumb and held in position until sufficient soil has been firmly placed around root system or ball. In relation to the surrounding grade, the plant material shall be set even with the grade at which it was grown.

3.3.1.1 Bare-Root Plant Material

Bare-root plant material shall be placed in water a minimum 30 minutes

prior to setting.

3.3.2 Tree Root Barrier

Tree root barriers shall be installed as recommended by the manufacturer. Tree root barriers shall be used for trees located up to a maximum 6 feet from paved surfaces or structures.

3.3.3 Backfill Soil Mixture

The backfill soil mixture may be a mix of topsoil and soil amendments suitable for the plant material specified. When practical, the excavated soil from the plant pit that is not amended provides the best backfill and shall be used.

3.3.4 Backfill Procedure

Prior to backfilling, all metal, wood, synthetic products, or treated burlap devices shall be removed from the ball or root system avoiding damage to the root system. The backfill procedure shall remove air pockets from around the root system. Additional requirements are as follows.

3.3.4.1 Balled and Burlapped, and Balled and Platformed Plant Material

Biodegradable burlap and tying material shall be carefully opened and folded back from the top a minimum 1/3 depth from the top of the root ball. Backfill mixture shall be added to the plant pit in 6 inch layers with each layer tamped.

3.3.4.2 Bare-Root Plant Material

The root system shall be spread out and arranged in its natural position. Damaged roots shall be removed with a clean cut. The backfill soil mixture shall be carefully worked in amongst the roots and watered to form a soupy mixture. Air pockets shall be removed from around the root system, and root to soil contact shall be provided.

3.3.4.3 Container-Grown and Balled and Potted Plant Material

The plant material shall be carefully removed from containers that are not biodegradable. Prior to setting the plant in the pit, a maximum 1/4 depth of the root mass, measured from the bottom, shall be spread apart to promote new root growth. For plant material in biodegradable containers the container shall be split prior to setting the plant with container. Backfill mixture shall be added to the plant pit in 6 inch layers with each layer tamped.

3.3.4.4 Earth Berm

An earth berm, consisting of backfill soil mixture, shall be formed with a minimum 3 inch height around the edge of the plant pit to aid in water retention and to provide soil for settling adjustments.

3.3.5 Plant Bed

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas. Earth berms shall be provided.

The planter beds around the patio area should have all soils amended rather than just the soil of the plant pits. Apply evenly: 6-20-20- pre-plant fertilizer at the rate of 20 lbs./1,000 sq. ft., humus (composted, nitrolized bark fines) at 6 c.y./1,000 sq. ft. and soft rock phosphate at 50 lbs/1,000 sq. ft. Incorporate thoroughly into top 6"-8" of planter soil.

3.3.6 Watering

Plant pits and plant beds shall be watered immediately after backfilling, until completely saturated.

3.3.7 Staking and Guying

Staking will be required when trees are unstable or will not remain set due to their size, shape, or exposure to high wind velocity.

3.3.7.1 One Bracing Stake

Trees 4 to 6 feet high shall be firmly anchored in place with one bracing stake. The bracing stake shall be placed on the side of the tree facing the prevailing wind. The bracing stake shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly to the stake with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. A chafing guard shall be used when metal is the guying material.

3.3.7.2 Two Bracing Stakes

Trees from 6 to 8 feet height shall be firmly anchored in place with 2 bracing stakes placed on opposite sides. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly between the stakes with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Chafing guards shall be used when metal is the guying material.

3.4 FINISHING

3.4.1 Plant Material

Prior to placing mulch, the installed area shall be uniformly edged to provide a clear division line between the planted area and the adjacent area, shaped as indicated. The installed area shall be raked and smoothed while maintaining the earth berms.

3.4.2 Placing Geotextile

Prior to placing mulch, geotextile shall be placed as indicated in accordance with the manufacturer's recommendations.

3.4.3 Placing Mulch

The placement of mulch shall occur a maximum 48 hours after planting. Top dress all shrub and ground cover areas with 3 inches of shredded fir bark mulch.

3.4.4 Pruning

Pruning shall be accomplished by trained and experienced personnel. The pruning of trees shall be in accordance with ANSI A300. Only dead or broken material shall be pruned from installed plants. The typical growth habit of individual plant material shall be retained. Cuts shall be made as close to the parent trunk as possible while still leaving the branch collar intact on the trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

3.5 MAINTENANCE DURING PLANTING OPERATION

Installed plant material shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed to prevent desiccation and shall continue until the plant establishment period commences. All trees, shrubs and ground cover areas shall be kept at optimum growing condition by watering, weeding, replanting, fertilizing, cultivating, repairing stakes and ties, restoring water basins, spraying for disease and insects, removing and replacing dead or dying plant material, pruning as directed, maintaining proper grades of plants and providing any other reasonable operations of maintenance and protection required for successful completion of the project. All plantings shall be presented in a 100% weed free condition at the final walk through.

3.6 RESTORATION AND CLEAN UP

3.6.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

3.6.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite. Adjacent paved areas shall be cleared.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02950

IRRIGATION SYSTEM

03/01

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 REQUIREMENTS
- 1.5 SYSTEM PERFORMANCE REQUIREMENTS
 - 1.5.1 Location of Sprinklers and Devices
 - 1.5.2 Minimum Water Coverage
- 1.6 DELIVERY AND STORAGE
- 1.7 JOB SITE CONDITIONS
- 1.8 CODE RULES AND SAFETY ORDERS
- 1.9 SEQUENCING AND SCHEDULING
- 1.10 QUALITY ASSURANCE
 - 1.10.1 Installer Qualifications
 - 1.10.2 Listing/Approval Stamp, Label, or Other Marking
 - 1.10.3 Product Options
- 1.11 AS-BUILT DRAWINGS
- 1.12 GUARANTEE AND REPLACEMENT

PART 2 PRODUCTS

- 2.1 GENERAL MATERIALS
- 2.2 PIPING MATERIALS
 - 2.2.1 Pipe, Fittings and Solvent Cement
 - 2.2.2 Sleeves
 - 2.2.3 Risers
 - 2.2.4 Riser Thread Coating
- 2.3 SPRINKLER HEADS
- 2.4 EMITTER ASSEMBLY
- 2.5 VALVES
 - 2.5.1 Gate Valves
 - 2.5.2 Angle Valves
 - 2.5.3 Quick Coupling Valves
 - 2.5.4 Electrical Remote Control Valves
 - 2.5.5 Backflow Preventers
- 2.6 ACCESSORIES AND APPURTENANCES
 - 2.6.1 Valve Keys
 - 2.6.2 Irrigation Boxes
 - 2.6.3 Concrete Pads
 - 2.6.4 Drainage Backfill for Control Valve Boxes

- 2.7 AUTOMATIC CONTROLLERS
 - 2.7.1 Controllers
 - 2.7.2 Housing
 - 2.7.3 Timing
 - 2.7.4 Chart
 - 2.7.5 Electrical Wiring
- 2.8 WIRING AND RIGID CONDUIT
- 2.9 MISCELLANEOUS ITEMS
 - 2.9.1 Service Clamps
 - 2.9.2 Above Ground Piping
 - 2.9.3 Below Ground Piping

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Sprinkler System
 - 3.1.2 Delivery
 - 3.1.3 Trench
 - 3.1.4 Utility Poles
 - 3.1.5 Piping System - Common Requirements
 - 3.1.6 Piping Installation
 - 3.1.7 Valves
 - 3.1.8 Sprinklers and Valves
 - 3.1.9 Emitter Assembly
 - 3.1.10 Backflow Preventer
 - 3.1.11 Control Wire and Conduit
 - 3.1.12 Automatic Controllers
- 3.2 BACKFILL
- 3.3 ADJUSTMENTS
- 3.4 FLUSHING AND CLEANING
- 3.5 FIELD TESTS
- 3.6 ADJUSTING

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 02950

IRRIGATION SYSTEM

03/01

PART 1 GENERAL

1.1 SUMMARY

This Section describes the labor, materials, and installation of equipment necessary to install an underground irrigation system.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1785	(1991) Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(1989) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1991) Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1990a) Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1987) Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings, Schedule 80
ASTM D 2564	(1991) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1013	(1988) Reduced Pressure Principle Backflow Preventers
-----------	---

FEDERAL SPECIFICATIONS (FS)

FS WW-H-001220	(Basic) Head, Sprinkler, (Underground Connected)
----------------	--

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-80 (1987) Bronze Gate, Globe, Angle and Check
Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (1988) (Rev 1) Industrial Control Devices,
Controllers and Assemblies

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1994) National Electrical Code

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Product Data; FIO.

Submit list of materials proposed for use. Give each item name of manufacturer, brand name and catalog number. Data shall include pressure rating, rated capacity, settings, and electrical information of selected models for the following:

1. Pressure regulators.
2. Valves, including general-duty, underground, manual and automatic control, and quick-coupler types, and valve boxes.
3. Sprinklers, including emitters, drip tubes, and devices.
4. Controls, including controller wiring diagrams.
5. Wiring.

SD-04 Drawings

Wiring Diagrams; FIO.

Wiring diagrams for electrical controllers, valves, and devices.

SD-08 Statements

Warranties and Guarantees; FIO.

Submit all written warranties and guarantees to Contracting Officer. All warranties and guarantees shall be for the manufacturer's specified time.

SD-09 Reports

Performance Test; FIO.

Showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of control valves.

SD-19 Operation and Maintenance Manuals

Manuals; FIO.

Furnish manuals for maintenance and operation of the following:

1. Pressure regulators.
2. Automatic control valves.
3. Sprinklers.
4. Controllers.

Furnish one complete set prior to field testing and the remainder upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule.

1.4 REQUIREMENTS

Furnish and install new automatic irrigation system as shown on the drawings and as specified herein.

Any section of pipe or any component of the irrigation system found to be defective shall be replaced at no additional expense to the government.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

1.5.1 Location of Sprinklers and Devices

Design location is approximate. MINOR adjustments may be made as necessary to avoid plantings and obstructions such as signs, utilities, and light standards. Variation in arrangement of sprinklers and devices from those shown on drawings will be permitted with written approval only. If such variation is made, the contractor shall submit a shop drawing for approval.

1.5.2 Minimum Water Coverage

Not less than:

- A. Turf Areas: 100 percent.
- B. Other Planting Areas: 100 percent.

1.6 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be protected from the weather, excessive humidity and temperature variation, direct sunlight (in the case of plastic or rubber materials), and dirt, dust, or other contaminants.

1.7 JOB SITE CONDITIONS

Verify conditions on site before commencing work. Should utilities be encountered that are not indicated, notify the Contracting Officer immediately. Mark high voltage electrical services with proper warning signs and barricades. Verify all dimensions in the field and advise the Contracting Officer of any discrepancy before performing the work.

Exercise extreme care in excavating near existing structures, trees and utilities to avoid damage. Repair or replace damage caused by this operation at no additional cost to the government.

1.8 CODE RULES AND SAFETY ORDERS

All work installed or material used must comply with the latest rules and regulations of National Electrical Code, Uniform Plumbing Code and Associated IAMPO Installation Standards.

1.9 SEQUENCING AND SCHEDULING

Maintain uninterrupted water service to building during normal working hours. Arrange for temporary water shutoff with the Government.

If water service for irrigation to existing landscaping is interrupted during construction, Contractor shall provide temporary irrigation system, as necessary, to maintain all affected plantings in healthy condition.

1.10 QUALITY ASSURANCE

1.10.1 Installer Qualifications

Experienced installer who has completed irrigation systems similar in material, design, and extent to that indicated for project that have resulted in construction with a record of successful in-service performance.

1.10.2 Listing/Approval Stamp, Label, or Other Marking

On equipment, specialties, and accessories made to specified standards.

1.10.3 Product Options

Irrigation system piping, specialties, and accessories are based on specific types, manufacturers, and models indicated. Components with equal performance characteristics produced by other manufacturers may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as judged by the Contracting Officer. The burden of proof of product equality is on the Contractor.

1.11 AS-BUILT DRAWINGS

Keep graphic record of field revisions to design layout. Contractor shall furnish final as-built drawings as indicated in Section 01300.

1.12 GUARANTEE AND REPLACEMENT

All components of the irrigation system shall be guaranteed against defects for a period of one (1) year, following Contracting Officer acceptance of the project. Replacement of defective components shall be made in the same manner as specified for the original plan at no extra cost to the government.

PART 2 PRODUCTS

2.1 GENERAL MATERIALS

A. Each item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

B. The following extra stock shall be provided: Two sprinkler heads of each size and type, two valve keys for operating manual valves, two wrenches for removing and installing each type of head, two quick coupler keys and hose swivels, and four irrigation controller housing keys.

2.2 PIPING MATERIALS

2.2.1 Pipe, Fittings and Solvent Cement

A. Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 40 and 80.

B. Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40. Threaded type fittings shall conform to requirements of ASTM D 2464, Schedule 80.

C. Solvent cement shall conform to the requirements of ASTM D 2564.

2.2.2 Sleeves

Sleeves under walkway paving shall be schedule 40, polyvinyl chloride 1120 normal impact pipe conforming to ASTM D1785.

2.2.3 Risers

Plastic pipe for risers shall be Schedule 80 and shall conform to ASTM D 2241 and shall meet the requirements for portable water.

2.2.4 Riser Thread Coating

For plastic pipe use MIL-T-27730A-1964, Tape, antiseize, Polytetrafluorethylene with dispenser (PFE TAPE) or as per manufacturer's recommendations.

2.3 SPRINKLER HEADS

A. Pop-Up Spray Heads shall conform to the requirements of FS WW-H-001220, Type II, Class A. Nozzle shall rise a minimum of 4 inches above body in lawns and 6 inches or 12 inches in groundcover and shrub areas. Sprinkler heads shall be conical spray with adjustable or non-adjustable coverage and designed for permanent above ground mounting on riser. All heads shall have built-in check valves. Spray heads and interchangeable nozzles to be Rainbird 1800 Series or approved equal.

B. Bubbler Heads shall be stream, umbrella or trickle bubbler with pressure compensation and designed for permanent above ground mounting on risers or, using an adapter, on pop-up bodies as specified above. Bubblers to be pressure compensating bubblers. Bubblers to be by Rainbird Sprinkler Corp., or approved equal.

2.4 EMITTER ASSEMBLY

A. The emitters shall be of pressure compensating a continuous flushing type known as a Groove and Flap Short Path Emitter. The case of the emitter shall be made of durable black, plastic material. It shall be resistant to temperature variation, ultraviolet radiation, smog (ozone), common liquid fertilizer and weed spray. The case shall completely encompass the diaphragm, protecting it from potentially harmful environmental factors.

B. The emitter shall be capable of continuous, self-flushing, clog-free operation with 200 mesh (minimum) filtration for 1/2 GPH and 150 mesh for 1 and 2 GPH emitter. The emitter shall be capable of being installed in any position and maintain its given flow characteristics. The emitter shall be non-adjustable and the flow regime shall be maintained by a flexible silicon rubber diaphragm.

C. The emitter shall function with a system pressure range of 5 psi minimum to 50 psi maximum.

D. The 2 GPH emitter shall be capable of delivering 2.05 gph at 20 psi, 1.75 gph at 50 psi.

E. The 1 GPH emitter shall be capable of delivering 1 gph at 20 psi, 1 gph at 50 psi.

F. The 1/2 GPH emitter shall be capable of delivering .5 gph at 20 psi, .45 gph at 50 psi.

G. The emitter distribution tubing between the emitter and the .580 inch OD emitter hose shall be .187-inch ID, .250-inch OD. The tubing between the emitter outlet and the point of discharge shall be vinylized .150-inch ID, .220- inch OD. All tubing shall fit tightly with the corresponding emitter barbs, adapters and discharge outlet openings.

2.5 VALVES

2.5.1 Gate Valves

Gate Valves, less than 3 Inches shall conform to the requirements of MSS SP-80, Type 1, solid wedge; nonrising, copper-silicon-alloy stem; Class 125, body and screw bonnet of ASTM B 62 cast bronze, with threaded or solder-joint ends. Include polytetrafluoroethylene (PTFE)-impregnated packing, brass packing gland, and malleable-iron handwheel.

2.5.2 Angle Valves

Angle Valves, less than 2-1/2 Inches shall conform to the requirements of MSS SP-80, Type 3, Class 150 with threaded or soldered ends.

2.5.3 Quick Coupling Valves

Quick Coupling Valves shall have brass parts and shall be two-piece unit consisting of a coupler water seal valve assembly and a removable upper body to allow spring and key track to be serviced without shutdown of main.

Lids shall be lockable vinyl with spring for positive closure on key removal.

2.5.4 Electrical Remote Control Valves

Electrical Remote Control Valves shall be solenoid actuated globe valves with self-cleaning nylon scrubber and stainless steel screen, of 1- to 3-inch size, suitable for 24 volts, 50/60 cycle, and designed to provide for shut-off in event of power failure. Construction shall be glass-filled nylon housing suitable for service at 200 psi operating pressure with external flow control adjustment for shut-off capability, external plug at diaphragm chamber to enable manual operation, filter in control chamber to prevent valve body clogging with debris, durable diaphragm, and accessibility to internal parts without removing valve from system.

R.C.V.'s to be Rainbird PEB series, or approved equal.

2.5.5 Backflow Preventers

A. Reduced pressure principle backflow preventers shall be in accordance with ASSE 1013.

B. Backflow prevention unit(s) of the type(s) indicated shall be installed above ground at the location(s) shown on the drawings. Where union connections are not provided as part of the unit, the Contractor shall provide and install a union or sleeve type coupling between the control valve and the inlet side of the unit. Pipe and fittings for backflow prevention units shall be copper. A minimum of five (5) feet of copper pipe shall be used on each side of this equipment from source as well as to valve assembly.

C. Reduced Pressure Type Backflow Preventers shall be Class 150 flanged bronze mounted gate valve and strainer, stainless steel or bronze, internal parts. Total pressure drop through complete assembly shall be a maximum of 10 psi at rated flow. Piping shall be red brass pipe and fittings or galvanized steel pipe and fittings. Strainers shall be bronze or brass construction with gasket caps. Units shall have 200-mesh stainless steel

screen elements.

2.6 ACCESSORIES AND APPURTENANCES

2.6.1 Valve Keys

Valve keys shall be 1/2-inch diameter by 3 feet long, tee handles and keyed to fit valves.

2.6.2 Irrigation Boxes

Irrigation boxes shall be Polyethylene (PE), acrylonitrile-butadiene-styrene (ABS), fiberglass or polymer concrete and cover. Size as required for application. The words "gate valve", for gate valves; and "RCA" for remote control valves shall be cast in covers of boxes for the irrigation system. The boxes shall be such length as will be adapted, without full extension, to the depth of cover required over the pipe at valve location. Plastic boxes shall be a standard catalog product of a manufacturer regularly engaged in the manufacture of valve boxes. Plastic boxes installed in turfed areas shall have green covers. Boxes housing control valves shall have lockable covers.

2.6.3 Concrete Pads

Concrete pads shall be precast or cast-in-place reinforced concrete construction for reduced pressure type backflow preventers.

2.6.4 Drainage Backfill for Control Valve Boxes

Drainage Backfill For Control Valve Boxes: Cleaned gravel or crushed stone, graded from 2 inches maximum to 3/4 inch minimum.

2.7 AUTOMATIC CONTROLLERS

2.7.1 Controllers

Controllers shall be the product of a manufacturer regularly engaged in the production of irrigation controllers and sprinkler systems and shall be specifically designed for use on landscaping. Controller shall be capable of complete automatic and manual operation of all connected stations. Each controller shall have a master switch to disconnect controller from supply lines. Controllers to be by Irritrol Systems or Rainbird Sprinkler Mfg. Corp., or approved equal. Model(s) to be as indicated on the drawings.

2.7.2 Housing

Controller shall be enclosed in a tamperproof, weatherproof and lockable housing.

2.7.3 Timing

Timing for each station shall be variable up to 99 minutes. The programming cycle shall be not less than 14 calendar days. Each station shall be independently timed, scheduled, or omitted. Programming shall be

changeable without special tools and without disassembling controller.

2.7.4 Chart

A chart, encased in plastic, showing clearly the areas serviced by each remote control valve shall be provided at each controller.

2.7.5 Electrical Wiring

Electrical wiring from controller to control valves shall be UL 493, solid, single conductor, copper wire, type RHW OR XHHWUF, rated for direct burial, with minimum wire size No. 14 AWG and No. 12 AWG to be used on runs of 2000 ft. or more. Common wire shall be a different color from all others. Regardless of the number or location of valves connected to a single controller station, separate control wires shall be run from the controller station to each valve. Wiring from controllers to source shall be installed in EMT steel, one-half (1/2) inch conduit minimum.

A. A master on/off button shall provide for system shut-down while maintaining programming. Electrical surge protection, lightning protection and battery back-up shall be an integral part of the controller and shall be provided on both the primary and circuit lines.

B. All programming shall be accomplished via keyboard entry with all readouts LED displayed.

C. Wire connections to remote control valves and at wire splices shall be made with UL approved, sealant (cycohexanone) filled, water-tight wire connectors installed as recommended by the manufacturer.

2.8 WIRING AND RIGID CONDUIT

Wiring and rigid conduit for electrical power shall be in accordance with NFPA 70.ND.

2.9 MISCELLANEOUS ITEMS

2.9.1 Service Clamps

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable iron body with cadmium plated straps and nuts. Clamps shall have rubber gasket cemented to the body.

2.9.2 Above Ground Piping

Above ground piping shall be copper.

2.9.3 Below Ground Piping

Pipe smaller than four (4) inches shall be plastic as specified on drawings. Pipe for sleeving shall be Schedule 40 or 80 PVC, as specified on drawings. PVC piping shall have metal locator tape marked.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Sprinkler System

Sprinkler system shall be installed after site grading has been completed. Excavation, trenching, and backfilling for sprinkler system shall be in accordance with the applicable provisions of Section 02300, Earthwork, except as modified herein.

3.1.2 Delivery

Pipes shall be delivered to site in unbroken bundles or rolls packaged in such a manner as to provide adequate protection for pipe ends, threaded or plain.

3.1.3 Trench

Trench around roots shall be hand excavated to pipe grade when roots of (two) 2 inches diameter or greater are encountered. Trench width shall be (four) 4 inches minimum or 1-1/2 times diameter of pipe, whichever is wider. Backfill shall be hand tamped over excavation. When rock is encountered, trench shall be excavated (four) 4 inches deeper and backfilled with silty sand (SM) or well-graded sand (SW) to pipe grade. Trenches shall be kept free of obstructions and debris that would damage pipe. Subsoil shall not be mixed with topsoil. Existing concrete walks, drives and other obstacles shall be bored at a depth conforming to bottom of adjacent trenches. Pipe sleeves for bored pipe shall be two pipe diameters larger than sprinkler pipe.

3.1.4 Utility Poles

Where necessary to excavate near utility poles, exercise care to avoid damage to pole and route underground piping a minimum of 2 feet from the base of the pole for 12-inch deep trenches and a minimum of 3 feet from the base of pole for 18-inch - 24-inch deep trenches.

3.1.5 Piping System - Common Requirements

A. The minimum backfill cover over pipe and wiring, except where shown otherwise on the drawings, shall be as follows:

1. Main Lines, Pressurized Pipe - 18 inches
2. 24 Volt Wiring - 18 inches, except where in sleeve under roadway
3. Lateral Lines, Non-Pressurized Pipe - 12 inches
4. Pipe Sleeves - 24 inches, as shown on detail drawings

B. Minimum horizontal clearances between lines shall be 4 inches for pipe 2 inches and less; 12 inches for 2-1/2 inches and larger. Minimum vertical clearances between lines shall be 1 inch.

C. Pipe shall be installed in a serpentine (snaked) manner to allow for

expansion and contraction in trench before backfilling. Pipes shall be installed at temperatures over 5 degrees C. (40 degrees F.). Allow joints to cure at least 24 hours at temperature above 40 deg F before testing, unless otherwise recommended by manufacturer.

3.1.6 Piping Installation

- A. Install underground polyvinyl chloride (PVC) plastic pipe according to ASTM D 2774.
- B. Solvent-cemented joints shall conform to the requirements of ASTM D 2855.
- C. Threaded joints shall be full cut with a maximum of three threads remaining exposed on pipe and nipples. Threaded joints shall be made tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.
- D. Piping shall be joined to conform with requirements of ASTM D 2774 or ASTM D 2855, and pipe manufacturer's instructions.
- E. Pipe shall be reamed and burrs removed. Contact surfaces of joint shall be cleaned and polished. Flux shall be applied to male and female ends. End of tube shall be inserted into fittings full depth of socket. After soldering, a solder bead shall show continuously around entire joint circumference. Excess acid flux shall be removed from tubings and fittings.
- F. Threads shall be cut in conformance with ASME B1.2. Pipe joint compound shall be applied to male end only.
- G. Piping under concrete may be installed by jacking, or hydraulic driving.
- H. Handling. Pipe and accessories shall be handled so as to ensure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. If the coating or lining of any pipe or fitting is damaged, the repair or replacement shall be made by the contractor at his expense in a satisfactory manner. Before installation the pipe shall be inspected for defects. Material found to be defective before or after placement shall be replaced with sound material without additional expense to the government.
- I. Install piping under sidewalks and paving in sleeves.

3.1.7 Valves

- A. Manual Valves shall be installed in a valve box extending from grade to below valve body, with a minimum of 4-inches cover measured from finish grade to top of valve stem.
- B. Automatic Valves shall be set plumb in a valve box extending from grade to below valve body, with minimum of 4-inch cover measured from grade to top of valve. Locate and arrange valves for easy adjustment and removal. Install union on downstream side.

C. Install valve box at each valve location with cover. Set top of box 1 inch above finish grade in lawn areas and 2 inches above finish grade in shrub beds. Place drain rock under all valves to a six inch depth with a three (3) inch clearance under each valve.

D. Entire system shall be manually or automatically drainable. Low points of system shall be equipped with drain valve draining into an excavation containing 1 cubic foot cleaned gravel or crushed stone, graded from 3 inches to 3/4 inch minimum. Cover drain material with sheet of ASTM D 226, Type II, asphalt-saturated felt and backfill remainder with excavated material and 6 inches of topsoil.

3.1.8 Sprinklers and Valves

Sprinklers and valves shall be installed plumb and level with terrain.

3.1.9 Emitter Assembly

A. The maximum length of the distribution tubing shall be as detailed on the project drawings. In the event the distance in the field exceeds the maximum length, the Contractor shall extend the .600 OD emitter hose as required by adding a tee and shall add a flush valve at the end of each extension. This work, if necessary, shall be performed at Contractor's expense and the emitter and distribution tubing shall be assembled using the manufacturer's recommended tools and accessories.

B. The emitter assembly shall consist of the emitter unit, flexible polyethylene emitter distribution tubings (length as required) and molded polyethylene adapter.

3.1.10 Backflow Preventer

A. Backflow Preventer shall be installed on the concrete pad between connection and control valves.

B. Reduced Pressure Type shall be installed as follows: Flush pipe lines prior to installing device and protect device by a strainer located upstream. Device shall not be installed in pits or where any part of device could become submerged in standing water. Install according to the details on the drawings and in accordance with the manufacturer's recommendations.

3.1.11 Control Wire and Conduit

A. Low voltage wires may be buried beside pipe in same trench. Rigid conduit shall be provided where wires run under paving. Wires shall be number tagged at key locations along main to facilitate service. One control circuit shall be provided for each zone and a circuit to control sprinkler system.

B. A 24-inch loop of wire shall be provided at each valve where controls are connected.

C. Multiple tubes or wires shall be bundled and taped together at 10 foot intervals with 12-inch loop for expansion and contraction.

D. Electrical splices shall be waterproof. Wire connections to remote control valves and at wire splices shall be made with UL approved, sealant (cycohexanone) filled, water-tight wire connectors installed as recommended by the manufacturer.

3.1.12 Automatic Controllers

Exact field location of Automatic Controllers shall be determined before installation. Coordinate the electrical service to these locations. Install in accordance with manufacturer's recommendations and NFPA 70.

3.2 BACKFILL

A. Top 3 inches of trench backfill shall be filled with topsoil. Compact soil in trenches with plate hand-held compactors to same density as undisturbed adjacent soil. Any settling of trenches within 90 days of project completion shall be corrected by the contractor at no additional cost to the government.

B. Complete backfilling only after piping has been inspected, flushed, and pressure tested. Backfill to be free from rocks, concrete chunks, and foreign material.

C. Plastic pipe laid in or across roadways or other locations which will be subject to vehicular traffic shall be placed in sleeves capable of withstanding the anticipated static and moving loads. Sleeves shall extend at least 18 inches beyond the edges of the pavement.

3.3 ADJUSTMENTS

After grading, seeding, and rolling of planted areas, sprinkler heads shall be adjusted flush with finished grade. Adjustments shall be made by providing new nipples of proper length or by use of heads having an approved device, integral with head, or by the use of swing joint assemblies, which will permit adjustment in height of head without changing piping.

3.4 FLUSHING AND CLEANING

Prior to the hydrostatic and operation tests, the interior of the pipe shall be flushed with clean water until pipe is free of all foreign materials. Flushing and cleaning out of system pipe, valves, and components shall not be considered completed until witnessed and accepted by Contracting Officer.

3.5 FIELD TESTS

A. All instruments, equipment, facilities, and labor required to conduct the tests shall be provided by Contractor.

B. Piping shall be tested hydrostatically before backfilling and proved

tight at a hydrostatic pressure of 150 psi without pumping for a period of one hour with an allowable pressure drop of 5 psi. If hydrostatic pressure cannot be held for a minimum of 4 hours, Contractor shall make adjustments or replacements and the tests repeated until satisfactory results are achieved and accepted by the Contracting Officer.

C. If solvent welded joints are used for plastic pipe, the line shall not be subjected to pressure testing for at least 24 hours following the completion of the line to be tested.

D. At conclusion of pressure test, sprinkler heads or emitter heads and quick coupling assemblies shall be installed and entire system tested for operation under normal operating pressure. Operation test consists of the system operating through at least one complete programmed cycle for all areas to be sprinkled.

3.6 ADJUSTING

A. Adjust all emitters, sprinklers, and bubblers, for proper pattern, water flow, and distance. Adjust any pressure regulators to specified pressures or as directed in the field.

B. At the initial installation, the pressure reducing valve shall be field adjusted to the manufacturer's recommended psi.

C. Automatic Controller System. Automatic controller system shall be installed at the location shown on the drawings, unless otherwise directed. Installation shall include connection to power supply of 105 to 125 volts and power step-down transformer connections to the individual valve solenoids as required for the automatic controller system. All electrical material provided and installed shall meet the latest issue of the electrical code for the area and all electric wire shall be U/L approved. The controller unit shall be provided with waterproof and dustproof cover. After completion of the installation, the system shall be adjusted and field tested to assure compliance with the manufacturer's capabilities and operational control of each zone or station to satisfy the design requirements. All tests and operational compliance shall be subject to the acceptance and approval by the Contracting Officer.

D. Connect remote control valves on system to controller in sequence to correspond with station setting beginning with station 1, 2, 3, etc.

E. Test controller for minimum of 10 days before end of establishment period. System shall operate automatically in manner specified. Set controller for night watering, between 11:00 pm and 8:00 am, or as directed.

F. Instruct government maintenance personnel by a qualified person of the manufacturer's representative on use and adjustment of automatic sprinkler controller during this 10 day test period.

G. Contractor shall adjust heads in turf areas flush with settled, finished grade prior to final completion of planting operations as directed by the Contracting Officer. Sprinkler heads and valves shall be installed in accordance with the recommendations of the manufacturer. Uniform and

complete coverage of the areas to be irrigated shall be obtained. All sprinkler heads of the same type and capacity on a single control valve shall be adjusted to provide coverage consistent with each other and to minimize overspray onto adjacent paving or buildings.

H. The Contractor shall assume full responsibility for the correct installation of the emitter system, as herein specified and unless he can show past experience of installing this type of system, he shall arrange with the manufacturer for the services of a qualified manufacturer's representative to be on hand at the start of the installation and as necessary during the installation and testing of the system. All emitter hose shall be flushed prior to and after installation of emitter assemblies. Attach manual self-closing flush valve at the end of each line.

I. A field training course shall be provided for designated operating and maintenance staff members. Training shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals. Provide 7 days written notice in advance of training.

J. Develop watering schedule to provide watering for planting during 90-day establishment period and for lawn during 90-day establishment period. Submit watering schedule to the Contracting Officer for approval. The sprinkler system shall be maintained by the contractor during establishment period.

K. After completion of all work, set automatic sprinkler controller to operate on schedule commensurate with good water practices according to local weather and soil conditions. Submit watering schedule with recommended seasonal variations in the schedule to the Contracting Officer for approval.

L. Upon completion of installation of system, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02230

CLEARING AND GRUBBING

03/01

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Clearing

1.1.2 Grubbing

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

3.2 GRUBBING

3.3 TREE REMOVAL

3.4 DISPOSAL OF MATERIALS

-- End of Section Table of Contents --

SECTION 02230

CLEARING AND GRUBBING
03/01

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Clearing

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared.

1.1.2 Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work as noted on the Drawings.

3.2 GRUBBING

Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and

compacted to make the surface conform with the original adjacent surface of the ground.

3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.4 DISPOSAL OF MATERIALS

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of off Base at the Contractor's responsibility, except when otherwise directed in writing. Refer to Section 01410 Environmental Protection.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02300

EARTHWORK

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 ADDITIONAL SAFETY RESPONSIBILITIES
- 1.3 DEFINITIONS
 - 1.3.1 Satisfactory Material
 - 1.3.2 Unsatisfactory Material
- 1.4 SUBMITTALS
- 1.5 SUBSURFACE DATA
- 1.6 EXPLOSIVES
- 1.7 UTILIZATION OF EXCAVATED MATERIALS

PART 2 PRODUCTS

- 2.1 MATERIALS

PART 3 EXECUTION

- 3.1 CONTROL OF WATER
- 3.2 EXISTING UTILITIES
- 3.3 GENERAL CONSTRUCTION REQUIREMENTS
- 3.4 SITE GRADING
- 3.5 TRENCH EXCAVATION
- 3.6 EXCAVATION FOR STRUCTURES
- 3.7 SUPPORT OF EXCAVATIONS
- 3.8 BACKFILL
 - 3.8.1 Trench Backfill
 - 3.8.2 Structural Backfill
 - 3.8.3 Native Backfill
- 3.9 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS (NOT USED)
- 3.10 SUBGRADE PREPARATION
 - 3.10.1 Compaction
- 3.11 TESTING
- 3.12 FINISH GRADING

-- End of Section Table of Contents --

SECTION 02300

EARTHWORK

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 1140	(1997) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(1994) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and

Plasticity Index of Soils

Standard Specifications (1999) State of California, Department of Transportation

Manual of Test (California Test) State of California, Department of Transportation

29 CFR Part 1926 CalOSHA Subpart P excavations and Trenches

1.2 ADDITIONAL SAFETY RESPONSIBILITIES

The Contractor shall select, install and maintain shoring, sheeting, bracing, and sloping as necessary to maintain safe excavations. The Contractor shall be responsible for ensuring such measures: (1) comply fully with 29 CFR Part 1926 OSHA Subpart P Excavations and Trenches requirements, (2) provide necessary support to the sides of excavations, (3) provide safe access to the Contracting Officer's sampling and testing within the excavation, (4) provide safe access for backfill, compaction, and compaction testings, and (5) otherwise maintain excavations in a safe manner that shall not endanger property, life, health, or the project schedule. All earthwork shall be performed in strict accordance with applicable law, including local ordinances, applicable OSHA, CalOSHA, California Civil Code, and California Department of Industrial Safety requirements.

1.3 DEFINITIONS

1.3.1 Satisfactory Material

Satisfactory materials are materials that classify according to ASTM D 2487 and GW, GP, GC, GM, SW, SP, SC, SM, CL, ML, and combinations of these such as SP-SM, etc. In addition, satisfactory materials shall have a maximum particle size of 2 inches or less and shall be free of organic matter and debris. Onsite materials that meet this definition are satisfactory for building pads and subgrades, except for that soil placed below the 100,000 gallon backwash water storage tank.

1.3.2 Unsatisfactory Material

Unsatisfactory material include material classified according to ASTM D 2487 as MH, CH, OL, OH and PT

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Compaction Testing; FIO.

Potholing Report as described in Paragraph 3.2.

Sheeting and Shoring Plan: Refer to paragraph 1.2 above.

SD-13 Certificates

Source Quality Control; FIO.

Gravel plant gradation certificate for imported materials. Materials proposed for use to demonstrate that the materials conform to the specified requirements.

1.5 SUBSURFACE DATA

Subsurface soil boring logs are shown on the drawings. The subsoil investigation report and samples of materials taken from subsurface investigations was completed by the U.S. Army Corps of Engineers may be examined by bidders at U.S. Army Corps of Engineers, 1325 J Street, Sacramento, California. The data represents the best subsurface information available; however, variations may exist in the subsurface between boring locations. While the records of data obtained may be considered by the Contractor to be correct, any conclusions or recommendations made in the reports are for information to the Design Engineer and are not a part of the Contract Documents.

1.6 EXPLOSIVES

The use of explosives will not be permitted for this project.

1.7 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Excess satisfactory material shall be hauled and stockpiled by the Contractor at a designated location on base where directed by the Contracting Officer. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion in accordance with the plans. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way. Excess rock as determined by the Contracting Officer shall be hauled off base and disposed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Crushed Rock: Class 2, 3/4-inch maximum aggregate base, Standard Specifications Section 26.

B. Pipe Bedding Materials:

1. Sand: Standard Specifications, Paragraph 19-3.025B.
2. Permeable Material: Standard Specifications, Paragraph 68-1.025 Class I, Type A.

C. Import Backfill: Imported nonexpansive soil with liquid limit no greater than 40% and a plasticity index no greater than 15%, free from clods or rocks larger than 2 inches in greatest dimension, and free from organic material.

D. Native Backfill: Excess excavated material, or "spoil" consisting of native soil prepared as necessary to be free from clods or rocks larger than 2 inches in greatest dimension, and free from organic material.

E. Landscape Fill: Import backfill free from chemicals, salts or other materials harmful to plant growth.

F. Impervious Material: Clay with a minimum percentage of material passing the No. 200 sieve of 50%. The material shall be free of organics, rocks, or clods greater than 2 inches in diameter.

G. Water: The water used shall be reasonably free of objectionable quantities of silt, oil, organic matter, alkali, salts and other impurities. Water quality must be acceptable to the Contracting Officer.

H. Aggregate Base: Class 2, 3/4-inch maximum. Standard Specifications, Section 26.

PART 3 EXECUTION

3.1 CONTROL OF WATER

A. All excavations shall be kept free from water and all construction shall be in the dry.

1. It should be presumed that the presence of groundwater will require dewatering operations. Furnish, install, maintain, and operate all necessary pumping and other equipment for dewatering all excavations. At all times have on the project sufficient pumping equipment for immediate use, including standby pumps for use in case other pumps become inoperable.
2. Provide a sufficient number of pumps so as to hold the groundwater level at an elevation of not less than 1 foot below the lowest elevation of the pipe, duct or other material to be placed.
3. Dispose of water in such a manner as to cause no injury or nuisance to the property, or be a menace to the public health.
4. The dewatering operation shall be continuous, so that the excavated areas shall be kept free from water during construction, while concrete is setting and achieves full strength, and until backfill has been placed to a sufficient height to anchor the work against possible flotation.
5. Continue dewatering during backfilling operations such that the groundwater is at least 1 foot below the level of the compaction effort at all times. No compaction of saturated materials will be allowed.

6. Dewatering devices must be adequately filtered to prevent the removal of fines from the soil.

7. The Contractor shall be responsible for any damage to the foundations or any other parts of existing structures or of the new work caused by failure of any part of the Contractor's protective works. After temporary protective works are no longer needed for dewatering purposes, they shall be removed by the Contractor.

8 If pumping is required on a 24-hour basis, requiring engine drives, then engines shall be equipped in a manner to keep noise to a minimum.

9. Prevent disposal of sediments from the soils to adjacent lands or waterways by employing whatever methods are necessary, including settling basins.

B. The Contractor shall be responsible for furnishing temporary drainage facilities to convey and dispose of surface water falling on or passing over the site.

3.2 EXISTING UTILITIES

A. General: The known existing utilities and pipelines are shown on the Drawings in their approximate location. The Contractor shall exercise care in avoiding damage to all utilities as he will be held responsible for their repair if damaged. There is no guarantee that all utilities or obstructions are shown, or that locations indicated are accurate. Utilities are piping, conduits, wire, cable, ducts, manholes, pull boxes and the like, located at the project site and adjoining site.

Before performing any excavation, grading, trenching or other operations whereby existing underground utilities may be damaged, the Contractor shall obtain a digging permit by completing an AF Form 103. Note that this process may take two weeks, therefore the Contractor shall plan work accordingly. The digging permit will list points of contacts (POCs) and telephone numbers for each of the various underground utilities (Telephone, gas, water, electrical, etc..) existing in the work area. It shall be the Contractor's responsibility to contact POCs for each utility listed, request that any utilities existing in the work area be marked, and obtain each POC's certification on the form. After each POC has been contacted and has certified such by signing or initialing the form, the form shall then be delivered to the government inspector. The Government (or Owner, in the case of privately owned utilities such as telephone service) will be responsible for marking the location of utilities in the work area. Typically, flags and/or paint will be used to mark the each and/or pavement to provide semi-permanent identification of the utility location. No indication/marketing of the depth of the utility below the existing grade will be provided. The Contractor shall allow sufficient time for the Government to accomplish this task at no additional cost to the Government.

Once the utilities are marked, the Contractor shall be responsible for maintaining the flags/paint at their proper location(s). No excavation will be permitted until all utilities existing in the area have been marked. The Contractor shall be responsible for the repair of any underground utility is within a lateral zone 3 feet on either side of the Government/Commercial-provided mark indicating the location of that utility. This 3-foot zone on either side of the mark provided is a hand-dig only area. Since depth of the utility will not be provided, the

Contractor assumes responsibility for any depth determination necessary.

B. Check on Locations (Potholing): Contact all affected utility POCs and request them to locate their respective utilities prior to the start of "potholing" procedures. The utility POC shall be given 7 days written notice prior to commencing potholing. If a utility POC is not equipped to locate its utility, the Contractor shall locate it.

C. Clearly paint the location of all affected utility underground pipes, conduits and other utilities on the pavement or identify the location with suitable markers if not on pavement. In addition to the location of metallic pipes and conduits, non-metallic pipe, ducts and conduits shall also be similarly located using surface indicators and detection tape if present and shall then be similarly marked.

D. After the utility survey is completed, commence "potholing" to determine the actual location and elevation of all utilities where crossings, interferences, or connections to new pipelines or other facilities are shown on the Drawings, marked by the utility companies, or indicated by surface signs. Prior to the preparation of piping shop drawings, or the excavating for any new pipelines or structures, the Contractor shall locate and uncover these existing utilities to a point 1 foot below the utility. Submit a report identifying each underground utility and its depth and location. Any variation in the actual elevations and the indicated elevations shall be brought to the Contracting Officer's attention.

E. Excavations around underground electrical ducts and conduits shall be performed using extreme caution to prevent injury to workmen or damage to electrical ducts or conduits. Similar precautions shall be exercised around gas lines, telephone and television cables. Backfill after completing potholing.

F. Interferences: If interferences occur at locations other than shown on the Drawings, the Contractor shall notify the Contracting Officer, and a method for correcting said interferences shall be supplied by the Contracting Officer. If the Contractor does not expose all required utilities prior to shop drawing preparation, he shall not be entitled to additional compensation for work necessary to avoid interferences, nor for repair to damaged utilities.

G. Any necessary relocations of utilities, whether shown on the Drawings or not, shall be coordinated with the affected utility. The Contractor shall perform the relocation only if instructed to do so in writing from the utility and the Contracting Officer.

H. Shutdowns: Planned utility service shutdowns shall be accomplished during period of minimum use. In some cases this may require night or weekend work. Such work shall be at no additional cost to the Government. Program work so that service will be restored in the minimum possible time.

1. Disconnections: No utility shall be disconnected without prior written approval from the Contracting Officer. When it is necessary to disconnect a utility, the Contractor shall give the Contracting Officer not less than 14 days notice when requesting written approval. The

Contractor shall program the work so that service will be restored in the minimum possible time.

I. Overhead Facilities: There are existing overhead electric and telephone transmission lines at the site. These overhead utilities may not be completely shown on the Drawings. Extreme caution shall be used when working in the vicinity of overhead utilities so as to prevent injury to workmen or damage to the utilities. The Contractor shall be required to comply with the applicable provisions of the California Construction Safety Orders when working anywhere on this project.

3.3 GENERAL CONSTRUCTION REQUIREMENTS

A. Site Access: Access to the site will be over public and private roads. Exercise care in the use of such roads and repair at own expense any damage thereto caused by Contractor's operations. Such repair shall be to the satisfaction of the Government or agency having jurisdiction over the road. Take whatever means are necessary to prevent tracking of mud onto existing roads and shall keep roads free of debris.

B. Barriers: Barriers shall be placed at each end of all excavations and at such places along excavations as may be necessary to warn all pedestrian and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely restored.

C. Demolition of Pavement: Where trenching or excavation occurs in paved areas, the pavement shall be cut and removed ahead of the trenching or excavation operation. The extent of paving removed shall be limited to the minimum necessary for the excavation.

D. Dust Control: Take proper and efficient steps to control dust.

E. Permits: Refer to Paragraph 3.2A.

F. Storage of Materials: Neatly place excavated materials far enough from the excavation to prevent stability problems. Keep the materials shaped so as to cause the least possible interference with plant operations and drainage.

G. Existing Facilities: Maintain access to existing facilities to permit continued operation. Maintain access for fire fighting equipment and to fire hydrants.

3.4 SITE GRADING

A. Rough Grading: After completion of stripping, rough grade cut areas to the lines, grades and contours shown on the Drawings.

B. Proof-Rolling: After rough grading, proof-roll the areas where fills, and on-grade structures are to be constructed in order to detect soft zones. Proof-roll by passing over all required areas with a loaded scraper, front-end loader with loaded bucket, or other heavy rubber tired vehicle

with high tire pressure. The Contracting Officer will determine what areas tested by proof-rolling are soft zones that require corrective work.

1. Soft Zone Corrective Work: Remove all soft material as indicated by the Contracting Officer from all soft zones exposed by proof-rolling. Properly dispose of unsuitable material off site.
2. Fill the resulting voids with moisture-conditioned native backfill or import backfill, in level 8-inch uniform layers measured before compaction. Compact with appropriate equipment to between 88% and 93% relative compaction. Moisture condition to within 2% optimum water content.

C. Scarifying: Upon completion and favorable review of the soft zone correction work scarify to a minimum 6-inch depth all areas where fills are required. Moisture condition the scarified surface to within 2% of optimum water content, and compact to a minimum 90% relative compaction.

D. Fills:

1. Do not place any fill until the Contracting Officer has inspected, tested to his satisfaction, and favorably reviewed the prepared subgrade.
2. Construct fills as shown on the Drawings, true to line, grade and cross-section. Construct fills of native backfill or import backfill. Place material in approximately 8-inch-thick horizontal layers measured before compaction, and carried across the entire width to the required slopes. Compact all fills to a relative compaction of at least 90% unless otherwise specified. Properly moisture condition before compaction.
3. Where fills are to be made and compacted on sloping ground surfaces, steeper than 5:1, such slopes shall be benched a minimum of 6 feet horizontally as the work is brought up. Recompact material thus removed by benching along with the new embankment material.
4. It may be necessary to overbuild slopes and trim back to the compacted core to achieve adequate compaction of slope faces.

E. Ditches: Cut ditches accurately to the cross sections and grades shown. Take care not to overexcavate ditches, and backfill excessive excavation to grade. Trim all roots, stumps, rock and other foreign matter from the sides and bottom of the ditches. Compact the surfaces of ditch slopes and bottom.

3.5 TRENCH EXCAVATION

A. Excavation for pipe and other utilities such as conduits shall be in open cut. The trench shall be as wide as necessary for sheeting and bracing and the proper performance of the work up to the maximum width permitted by the typical cross-sections shown on the Drawings. The sides of the trenches shall be vertical in paved areas. The bottom of the trench shall be constructed to the grades and shapes indicated on the Drawings. Should the Contractor desire to use other equivalent methods, he shall submit his method of construction to the Contracting Officer for favorable review prior to its use.

B. Take care not to overexcavate. Accurately grade the bottom of the trenches to provide uniform bearing and support for each section of the pipe or conduit at every point along its entire length, except for the

portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints, and as hereinafter specified. Dig bell holes and depressions for joints after the trench bottom has been graded. In order that the pipe rest on the bedding for as nearly its full length as practicable, bell holes and depressions shall be only of such length, depth and width as required for properly making the joint. Remove stones as necessary to avoid point bearing.

C. Backfill and compact overexcavations to 95% relative compaction with bedding material. There shall be no additional payment to the Contractor for over-excavations not directed by the Contracting Officer.

D. Grade trenches so that they are uniformly sloped between the pipe elevations shown on the Drawings. If no elevations are shown on the Drawings, provide 3 feet of minimum cover. Comply with the minimum and maximum trench widths shown on the Drawings. Notify the Contracting Officer if the trench width exceeds the maximum allowable width for any reason.

E. For all piping or conduits to be placed in any excavated and backfilled area, such as at manholes or for building connections, the structural backfill shall be first compacted to a level at least 3 feet from the top of the piping or conduit elevation and then retrenched to pipe grade.

F. Provide ladders for access to the trench by construction and inspection personnel.

3.6 EXCAVATION FOR STRUCTURES

A. All excavation for structures shall be done to the dimensions and levels indicated on the Drawings or specified herein. Excavate to such width outside the lines of the structure to be constructed as may be required for proper working methods, the erection of forms and the protection of the work.

B. Take care to preserve the foundation surfaces in an undisturbed condition. If the Contractor overexcavates or disturbs the foundation surfaces, without written authorization of the Contracting Officer, he shall replace such foundations with concrete fill or other material approved by the Contracting Officer in a manner which will show by test an equal bearing value with the undisturbed foundation material. No additional payment will be made for the added quantity of concrete fill or other material used because of overexcavation.

C. Inspection of Excavation: Notify the Contracting Officer when excavation for the structure is complete. No forms, reinforcing steel, concrete, or precast structure shall be placed until the excavation has been inspected by the Contracting Officer.

D. Where unsatisfactory material is encountered below the grades for structural excavations, it shall be removed and replaced with structural fill material as directed by the Contracting Officer and compacted to 95% maximum density.

3.7 SUPPORT OF EXCAVATIONS

A. Adequately support excavation for trenches and structures to meet all applicable requirements in the current rules, orders and regulations. Excavation shall be adequately shored, braced and sheeted so that the earth will not slide or settle and so that all existing structures and all new pipe and structures will be fully protected from damage. Keep vehicles, equipment, and materials far enough from the excavation to prevent instability.

B. Take all necessary measures to protect excavations and adjacent improvements from running, caving, boiling, settling, or sliding soil resulting from the nature of the soil excavated. Attention is directed to Section 832 of the Civil Code of the State of California relating to lateral subadjacent supports, and wherever structures or improvements adjacent to the excavation may be damaged by such excavation, the Contractor shall comply with this law.

C. The support for excavation shall remain in place until the pipeline or structure has been completed. During the backfilling of the pipeline or structure, the shoring, sheeting and bracing shall be carefully removed so that there shall be no voids created and no caving, lateral movement or flowing of the subsoils.

3.8 BACKFILL

3.8.1 Trench Backfill

A. Place bedding and backfill materials true to the lines, grades, and cross-sections indicated on the Drawings and compacted to the degree specified on the Drawings. Place bedding and backfill materials in horizontal lifts not to exceed 8 inches in thickness measured before compaction. The difference in level on either side of a pipe shall not to exceed 4 inches.

B. Backfill material shall not be placed over the pipe or conduit until after the joints have been completed and inspected by the Contracting Officer.

C. It shall be incumbent upon the Contractor to protect the pipe or conduit from damage during the construction period. It shall be his responsibility to repair broken or damaged pipe at no extra cost to the Government. Carefully place backfill around and over the pipe and do not allow it to fall directly upon the pipe. Tamping of backfill over the pipe shall be done with tampers, vibratory rollers and other machines that will not injure or disturb the pipe.

D. Do not allow traffic over the pipe trench until the trench backfill has been brought back even with existing adjacent grade.

3.8.2 Structural Backfill

A. Crushed Rock Subgrade: Place a layer of rock, compacted to at least 95% relative compaction under structures to the lines, grades and minimum

thicknesses shown on the Drawings. Unless shown specifically otherwise in the Drawings, do not use rock as backfill above the elevation of the highest base slab of the structure.

B. Backfill Adjacent to Structures:

1. Backfill shall be structural backfill compacted to at least 90% relative compaction.
2. Do not place backfill against structures until the concrete has been patched and cured.
3. Do not place backfill against structures until at least 28 days after the concrete was placed, or until the concrete has achieved a strength of at least 2,500 psi, whichever is earlier. Concrete strength shall be demonstrated by field cured cylinders tested at the Contractor's cost, prepared and tested in accordance with ASTM C 31 and ASTM C 39.
4. Do not place backfill against hydraulic structures until the structure has passed the specified leakage tests.
5. Place backfill in uniform, level layers, not exceeding 8 inches thick measured before compaction. Bring backfill up uniformly on all sides of the structure, and on both sides of buried walls.

3.8.3 Native Backfill

- A. Moisture condition of native backfill material to within 2% of optimum moisture content. Place fill in lifts no thicker than 8 inches and compact soil to within a range of 90% relative compaction.

3.9 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS (NOT USED)

3.10 SUBGRADE PREPARATION

3.10.1 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

- A. Add water to the backfill material or dry the material as necessary to obtain a moisture content within 2% of optimum. Employ such means as may be necessary to secure a uniform moisture content throughout the material of each layer being compacted.

- B. After the material has been moisture conditioned, compact it with compaction equipment appropriate for the use to achieve specified compaction.

- C. If the backfill material becomes saturated from rains or any other source because it was not compacted to the specified density or was not backfilled and compacted to surface grade, through negligence or otherwise, remove the faulty material and replace it with suitable material compacted to the specified density. No additional payment will be made for doing such work or removal and replacement.

- D. Compaction of embankment and backfill materials by flooding,

ponding or jetting will not be permitted.

E. When densities of compacted materials do not meet the requirements, remove and/or recompact the material until the requirements are met. The Contractor is responsible for all compaction tests and retesting.

3.11 TESTING

Testing Methods:

1. Durability Index: Manual of Test (California Test), Department of Transportation.
2. Specific Gravity: ASTM D 854
3. Laboratory Compaction: ASTM D 1557, Method A or C.
4. In-place Density: ASTM D 1556 or ASTM D 2922.
5. Particle Size Analysis of Soils: ASTM D 422.
6. Plastic Limit and Plasticity Index: ASTM D 4318.
7. Soil Classification: ASTM D 2487.
8. In-place Moisture Content: ASTM D 3017.

3.12 FINISH GRADING

Finish grade the site to the elevations shown on the Drawings. Finish grading shall be uniform and pleasing and shall provide drainage from all areas to collection points. The finished surfaces shall be smooth and compacted.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02510

WATER SYSTEM PIPING AND ACCESSORIES

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUMMARY
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
- 1.5 POTHOLING
- 1.6 CONSTRUCTION SCHEDULING/SEQUENCING

PART 2 PRODUCTS

- 2.1 GENERAL
- 2.2 PIPING MATERIALS
- 2.3 PIPE COUPLINGS
- 2.4 VALVES AND ACCESSORIES
- 2.5 APPURTENANCES

PART 3 EXECUTION

- 3.1 PIPING INSTALLATION
- 3.2 COUPLING INSTALLATION
- 3.3 INSTALLATION OF VALVES AND ACCESSORIES
- 3.4 INSTALLATION OF THRUST BLOCK
- 3.5 FIELD QUALITY CONTROL
- 3.6 CLEANING
- 3.7 FIELD TESTING
- 3.8 DISINFECTION OF POTABLE WATER SYSTEMS

-- End of Section Table of Contents --

SECTION 02510

WATER SYSTEM PIPING AND ACCESSORIES
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Association of State Highway and Transportation Officials
(AASHTO)

American National Standards Institute (ANSI)

American Society of Mechanical Engineers (ASME)

American Society for Testing and Materials (ASTM)

American Water Works Association (AWWA)

Cast Iron Soil Pipe Institute

1.2 SUMMARY

A. This section applies to the water distribution system piping only at the Housing Area (Drawing Sheets P1.0 to P6.0). For requirements of pipelines and liquid process piping at the water treatment plant refer to Section 15200.

B. Section Includes: Furnish and install all water distribution system piping, including fittings, valves, and accessories as shown on the Drawings, described in the Specifications and as required to completely interconnect all piping for a complete and operable system.

C. Related Sections:

1. Section 02300: Earthwork
2. Section 15200: Pipelines, Liquid Process Piping

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Data; FIO.

Submit data to show that the following items conform to the Specification requirements:

1. Pipe, fittings, and accessories.
2. Flexible couplings and flanged coupling adapters.
3. Restrained joints.
4. Valves and meters.

SD-04 Drawings

Shop Drawings; FIO.

Submit shop drawings if layouts are different from the Contract Plans.

Layouts and schematics: Submit detailed installation drawings of all piping and connected equipment. The drawings shall include each pipe, all fittings, valves, and other appurtenances.

SD-08 Statements

Procedures; FIO.

Disinfection schedule and procedures including:

1. Disinfection procedure.
2. Disinfecting agent(s).
3. Method of disposal of chlorinated water.

SD-19 Operation and Maintenance Manuals

Manuals; FIO

The Contractor shall furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for the following items:

All valves over 4-inch size.
Water meters.

1.4 QUALITY ASSURANCE

All materials and equipment furnished under this Section shall: (1) be of a manufacturer who has been regularly engaged in the design and manufacture of the materials and equipment and (2) be demonstrated that the quality is equal to the materials and equipment made by those manufacturers specifically named herein, if an alternate product manufacturer is proposed.

1.5 POTHOLING (CHECK ON LOCATIONS - The Contractor shall verify existing utilities and conditions, prior to ordering materials)

Do not prepare any shop drawings for, or make final order for, or design any pipe materials for any particular section of pipeline until all utilities in that section of pipeline have been exposed, as specified in paragraph 3.2 of Section 02300 and until such time as no interferences are

found between said existing utilities and the proposed pipeline alignment. If interferences are found in any particular section of pipeline, do not prepare any shop drawings for, or make final order for, or design any pipe materials for that particular section of pipeline until the pipeline alignment has been modified by the Contracting Officer and/or the Engineer to eliminate all such interferences.

1.6 CONSTRUCTION SCHEDULING/SEQUENCING

A. Construction under this Contract involves new water treatment plant. Existing water system must continue to provide service during construction. All scheduled outages shall be approved by the Contracting Officer.

B. Utilities connections and changes must be programmed to provide the least possible interruptions of service. Prior to any shutdown, all materials, fittings, supports, equipment and tools shall be on the site and all necessary labor scheduled prior to starting any connection work. The Contractor shall notify the Contracting Officer in writing at least 14 days in advance of any required shutdowns so that affected customers may be notified. In general, shutdowns shall not exceed four hours in duration unless specifically authorized or indicated in the suggested construction sequence. If a shutdown of more than four hours is required, the Contractor shall first install temporary water service connections to all affected houses and other buildings. All temporary piping shall be disinfected in accordance with Paragraph 3.7 before being put into service.

No utility interruption will be permitted without the prior approval of the Contracting Officer.

C. All work under this Contract shall be conducted in a manner which will minimize shutdowns, open trenches, or traffic obstructions caused by the construction. Shutdowns causing damage to government facilities and property shall not be permitted, and any damage resulting shall be the sole responsibility of the Contractor.

PART 2 PRODUCTS

2.1 GENERAL

A. Pipe and valve sizes are nominal inside diameter unless otherwise noted.

B. All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.

C. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the completed product. Acceptance of installed piping systems shall be based on inspection and leakage and bacteriological tests as specified hereinafter.

D. Buried nuts and bolts for flanges and couplings shall be Type 304 stainless steel unless otherwise specifically specified herein.

2.2 PIPING MATERIALS

- A. Pipe Designation: Piping materials are designated on the Drawings.
- B. Pipe Systems: Each designation identifies not only the pipe itself, but the entire system as well as including the associated fittings, appurtenances, and installation and test procedures.
- C. Ductile Iron (DI):
 - 1. Pipe: Ductile iron, Pressure Class 250, AWWA C151.
 - 2. Joints: Push-on, AWWA C111 as modified.
 - a. Gaskets: Natural rubber or neoprene.
 - b. Restrained joints: Where required by the Drawings, provide restrained joints capable of deflection. Joints shall not separate under an internal pressure of 250 psi. Mega-Lug by EBAA Iron, Inc. or equal.
 - 3. Fittings: Ductile iron or cast iron push-on joints, AWWA C110.
 - a. Special Fittings: Special fittings not available in ductile iron or cast iron pipe may be fabricated of fusion epoxy lined and coated welded steel pipe with a design pressure of 250 psi.
 - 4. Flanged pipe: Where flanges are necessary for connections to equipment or for insulated joints, pipe shall be thickness Class 53, AWWA C115.
- D. Polyvinyl Chloride Pipe:
 - 1. Pipe: Polyvinyl chloride pressure pipe, cast iron pipe outside dimensions. Pipe shall be UL listed or Factory Mutual Approved.
 - a. 4-inch through 12-inch: AWWA C900.
 - b. 14-inch through 36-inch: AWWA C905.
 - 2. Dimension ratio: 26.
 - 3. Joints:
 - a. Unrestrained joints: Bell and spigot, gasketed; or twin gasket coupling.
 - b. Restrained joints: Bell and spigot (push-on) gasketed, or mechanical joints; both using ductile iron clamp-on restraining devices.
 - 1) Restraining devices: Ductile iron with ductile iron or cor-ten rods and bolts. Pressure rating of at least 150 psi. Series 1500 by EBBA Iron; equivalent by Uni-Flange; or equal for bell and spigot joints. Series 500 by EBBA Iron; equivalent by Uni-Flange; or equal for mechanical joints.
 - 4. Gaskets: Isoprene.
 - 5. Fittings: Push-on cast iron or mechanical joint, AWWA C110, with hubs cast and/or ground as required for pipe furnished.

2.3 PIPE COUPLINGS

- A. General: For typical pipe joints refer to pipe material specifications. Other joint devices shall be furnished where called for as specified below.
- B. Flexible Couplings and Flange Coupling Adaptors:
 - 1. Sleeve: Cast iron or fabricated steel.
 - 2. Followers: Cast iron, ductile iron, or steel.
 - 3. Sleeve bolts: ASTM A325, Type 3; stainless steel; or equivalent.

4. Coating: Fusion epoxy line and coat sleeve and followers.
5. Pressure rating: 250 psi.
6. Buried flexible coupling sleeve: Long barrel
7. Manufacturers:
 - a. Flexible couplings:
 - 1) Connecting pipe with identical outside diameters: Smith-Blair 411 or 431, Dresser Style 38 or 53, or equal.
 - 2) Connecting pipe with slightly different outside diameters: Smith-Blair 413 or R 441, Dresser Style 162, or equal.
 - b. Flange coupling adaptors:
 - 1) Connecting new pipe or new pipe to existing non-ferrous pipe: Smith-Blair 912 or 913, Dresser Style 127 or 128, or equal.
 - 2) Connecting new pipe to existing ferrous pipe: Insulating flange coupling adaptor with insulating boot: Smith-Blair 932 or 933, or equal.
8. Gaskets: Oil and grease resistant; Smith-Blair Grade 60; or equal.
9. Joint restraint: Provide joint harnesses (tie rod lug or attachment plate assemblies) across flexible couplings and flange coupling adaptors where indicated on the Drawings. Design restraint in accordance with AWWA M-11 for 250 psi if size of the rods are not indicated on the Drawings. Provide lug type joint restraint as manufactured by EBBA-Iron or equal. Anchor studs will not be allowed except on a minimum thickness Class DI pipe Special Class 50.
10. Protection for buried connectors and adaptors: Double wrap with polyethylene encasement, AWWA C105 and tape the edges of the encasement with PVC tape.

2.4 VALVES AND ACCESSORIES

- A. General Requirements for Valves:
 1. All valves of each type shall be the product of one manufacturer.
 2. All valves shall be furnished with control assembly, operators, handwheels, levers, or other suitable type wrench including handles as specified herein or as shown on the Drawings.
 3. All threaded stem valves shall open by turning the valve stem counter-clockwise.
 4. The exterior of all valves and valve operators shall be painted with two coats of Tape Coat Mastic; Protecto Wrap CA1180 Mastic; or equal, except where otherwise indicated.
- B. Valves and Accessories:
 1. Butterfly valves:
 - a. Rating: 150 psi water. Leaktight in both directions.
 - b. Type: Flanged body, or as shown on the Drawings, AWWA C504, geared operator, resilient seated, 90 degree seating.
 - c. Connections: Flange, as shown on the Drawings.
 - d. Materials: Cast iron body; cast iron or ductile iron disc with Ni-Chrome or Type 316 stainless steel edge; Type 304 stainless steel shaft; disc to be secured to shaft with Type 304 stainless steel taper pins.
 - e. Operator: Traveling-nut type, 2-inch standard AWWA nut, designed for buried service, watertight to 10 psi with extension stem as detailed on the Drawings. Provide three valve operator tee handles to the Contracting Officer.

- f. Valve seat: Buna-N seat shall be applied to the valve body.
 - g. Bearings: Self-lubricating and corrosion resistant.
 - h. Finish: Internal, asphalt varnish in accordance with AWWA C504; external, factory applied coal tar epoxy, 16 mils minimum thickness.
 - i. Manufacturers: Pratt Groundhog, or equivalent by DeZurik, or equal.
2. Gate Valves:
- a. Rating: 200 psi water
 - b. Type: Resilient seated, non-rising stem, AWWA C509, as modified herein
 - c. Connection: Flanged or as shown on the Drawings
 - d. Stem seal: O-ring
 - e. Finish: Fusion epoxy
 - f. Manufacturers: American Darling CRS-80; Mueller; or equal.
3. Water meters: (Refer to Section 13405).
4. Valve boxes, adjustable screw type:
- a. Materials: Cast iron, top and center sections and base and cover.

2.5 APPURTENANCES

Provide all necessary assembly bolts, washers and nuts, thrust blocks, supports, gaskets, flanges, adapters, connections and all other appurtenant items shown on the Drawings, specified or required for the proper installation and operation of the piping, and devices included in or on the piping, equipment, and piping accessories.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

- A. General Handling and Placing:
- 1. Exercise great care to prevent injury to or scoring of the pipe lining and coating, as applicable, during handling, transportation or storage. Handle fusion epoxy coated pipe in accordance with AWWA C213. Pipe shall not be stored on rough ground and rolling of the pipe on the coating will not be permitted. Repair any damaged pipe sections, specials, or fittings or replace at the direction of the Contracting Officer.
 - 2. Inspect each pipe fitting, valve and accessory carefully before installation. Inspect the interior and exterior protective coatings and patch all damaged areas in the field or replaced at the direction of the Contracting Officer.
 - 3. Place or erect all piping to accurate line and grade and backfill, support, hang, or brace against movement as specified or shown on the Drawings, or as required for proper installation. Remove all dirt and foreign matter from the pipe interior prior to installation and thoroughly clean all joints before joining.
 - 4. Use reducing fittings where any change in pipe size occurs. Bushings shall not be used, unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.
 - 5. Connections between ferrous and non-ferrous piping and accessories

shall be made using a dielectric coupling, union, or flange.

B. General Buried Piping Installation:

1. Trenching, bedding, and backfill for buried piping shall be as shown on the Drawings and as specified in Section 02300.
2. Where no grade elevations are shown on the Drawings, buried piping shall have at least 3 feet of cover.
3. Provide each pipe with a firm, uniform bearing for its full length in the trench except at field joints. Do not lay pipe in water or when trench conditions or weather are unsuitable for such work.
4. Protect buried piping against thrust by use of restrained pipe joints, or thrust blocks if shown on the Drawings. Securely brace all exposed free pipe ends.
5. Do not pull bell and spigot, gasketed joints more than 75% of the maximum deflection permitted by the pipe manufacturer.

C. Water Main Installation:

1. The Contractor is advised that precautions taken to keep the pipeline clean during construction will facilitate achieving the disinfection requirements of this project with a minimum of effort and expense. Compliance with these suggested minimum procedures will not relieve the Contractor of the disinfection requirements.
2. Prior to installation, thoroughly clean the interior of each length of pipe and each fitting or valve and inspect to ensure that no foreign material remains. Cover both ends with plastic and do not uncover them until just prior to completing the joint.
3. Whenever pipe laying is discontinued for short periods, or whenever work is stopped at the end of the day, close the open ends of the pipe with watertight plugs or bulkheads.
4. Provide adequate trench pumping to ensure against groundwater contacting the inside of the pipeline at any time. Do not lower any pipe or fitting into a trench where groundwater is present and may enter the pipe. When necessary, pump the water from trenches and keep the trench dry until the joints have been completed and the open ends of the pipe have been closed with a watertight plug. Do not remove the plug until the trench has again been pumped dry.
5. Keep new pipe sections clean and dry.
6. When making the connection between a new pipeline and an existing pipeline, or when repairing a damaged pipe, take the following extra precautions:
 - a. Clean the exterior of the existing pipeline of all dirt and debris, and spray or swab with a standard 5.25% or stronger chlorine solution in the immediate vicinity of the work. Clean equipment and materials, including new pipe and fittings, to be used in making these connections of all dirt and debris and disinfect them. Allow at least 30 minutes contact time for disinfection before the chlorine solution is diluted or rinsed off. Provide sufficient trench pumps to prevent flooding of the trench.
 - b. When an old line is opened, either by accident or by design, the excavation may be wet or badly contaminated from groundwater. Apply liberal quantities of standard chlorine solution or tablets to the open trench areas to lessen the danger from such pollution. Tablets are recommended because they dissolve slowly and continue

to release hypochlorite as water is pumped from the excavation. Scatter liberally around and locate the tablets so that flow entering the work site will contact the disinfecting agent. Trench application should be done very carefully to avoid contact by skin and clothing with chlorine solution. Minimally, safety dictates wearing safety goggles and rain gear.

c. When excavating a leaking or broken pipeline, "valve-off" the system gradually to less than watertightness. This is to prevent causing areas of zero pressure which would allow entry of foreign material. A flow should be maintained which is slightly less than trench pump capability. Once the break is exposed and cleaned to disallow site contamination, the valving can then be made watertight.

D. Installation Specifics:

1. Ductile Iron Pipe:

a. Buried pipe shall be installed in accordance with AWWA C600.

b. Wherever the pipeline crosses over or under a sewer main or house service lateral, center a standard length pipe, 18-foot minimum, on said sewer main or lateral so as to have the pipeline joints as far as possible away from the sewer. This may require field cutting of some pipe pieces.

c. Flanged Joints: Flanged joints shall be made up tight with care being taken to avoid undue strain in the flanges, fittings, and other accessories. Bolt holes shall be aligned for each flanged joint. Bolts shall be full size for bolt holes; use of undersize bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Adjoining flange faces shall not be out of parallel to such a degree that the flanged joint cannot be made watertight without over-straining the flange.

Replace any flanged pipe or fitting whose dimensions do not allow the making of a proper flanged joint as specified herein by one of proper dimensions. Clean flanges prior to making joints.

d. Restrained Joints: Install in accordance with manufacturer's instructions. Pull slack out of joint after makeup.

2. Polyvinyl Chloride Pipe: Installation shall conform to AWWA M23, Chapters 6 and 7, as modified herein.

3.2 COUPLING INSTALLATION

Flexible Couplings and Flange Coupling Adaptors: Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Care shall be taken that the gaskets are wiped clean before they are installed. If necessary, flexible couplings and flanged coupling adapter gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Bolts shall be tightened progressively, drawing up bolt on opposite sides a little at a time until all bolts have a uniform tightness. Workers tightening bolts shall be equipped with torque-limiting wrenches or other favorably reviewed type. Anchor studs on restrained flanged coupling adapters shall be installed so as to lock into holes drilled through pipe wall in accordance with manufacturer's recommendation.

3.3 INSTALLATION OF VALVES AND ACCESSORIES

Use reducing fittings where any change in pipe size occurs between valves or accessories and the attached pipeline. Bushings shall not be used, unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines. Inspect each piece of pipe and each fitting carefully to see that there is no defective workmanship on pipe, or obstructions in pipes and fittings.

3.4 INSTALLATION OF THRUST BLOCK

Thrust blocks of 4,000 psi compressive strength concrete shall be cast-in-place at all horizontal or vertical bends of 11-1/4 degrees angle or more, behind each plug, cap, tee, or cross. The thrust block shall extend from the fitting to undisturbed soil, shall be kept clear of the joints, and shall be of such bearing area as to assure adequate resistance to the force to be encountered. Size of blocking shall be in accordance with the Drawing.

3.5 FIELD QUALITY CONTROL

A. The Government will:

1. Inspect field welds and test the welds if it is deemed necessary.
2. Perform bacteriological analysis for pipelines to be disinfected.

B. Factory Quality Control: The Contractor shall test all products as required herein and by the reference specifications.

C. The Contractor shall:

1. Perform leakage tests.
2. Be responsible for the costs of additional inspection and retesting by the Government resulting from non-compliance.

3.6 CLEANING

Prior to testing, the inside of each completed pipeline shall be thoroughly cleaned of all dirt, loose scale, sand and other foreign material. Cleaning shall be by sweeping, flushing with water, internal cleaning device or "pig" or blowing with compressed air, as appropriate for the size and type of pipe. Flushing shall achieve a velocity of at least 3 feet per second. The Contractor shall install temporary strainers, temporarily disconnect equipment or take other appropriate measures to protect equipment while cleaning piping. Cleaning shall be completed after any repairs.

3.7 FIELD TESTING

A. General: Perform leakage tests on all pipe installed in this project.

Furnish all equipment, material, personnel, test media and supplies to perform the tests and make all taps and other necessary temporary connections. The test pressure, allowable leakage and test medium shall be as specified. Perform leakage tests on all piping at a time agreed upon and in the presence of the Contracting Officer.

B. Buried Piping: Perform the leakage test for buried piping after all pipe is installed and backfilled. However, preliminary tests may be conducted prior to backfill. If preliminary tests are conducted, provide any necessary temporary thrust restraint.

C. Accessories: It is the responsibility of the Contractor to block off or remove equipment, valves, gauges, etc., which are not designed to withstand the full test pressure.

D. Testing Apparatus: Provide pipe taps, nozzles and connections as necessary in piping to permit testing, addition of test media, and draining lines and disposal of water, as is necessary. Plug these openings in a manner favorably reviewed by the Contracting Officer after use. Provide all required temporary bulkheads.

E. Correction of Defects: If leakage exceeds the allowable, repair or replace the installation and repeat leakage tests as necessary until conformance to the leakage test requirements specified herein have been fulfilled. All visible leaks shall be repaired even if the pipeline passes the allowable leakage test.

F. Reports: Keep records of each piping test, including:

1. Description and identification of piping tested.
2. Test pressure.
3. Date of test.
4. Witnessing by Contractor and Contracting Officer and/or designated representative.
5. Test evaluation.
6. Remarks, to include such items as:
 - a. Leaks (type, location).
 - b. Repairs made on leaks.
 - c. Submit test reports to the Contracting Officer.

G. Venting: Where not shown on the Drawings, the Contractor may install valved "TEES" or corporation stops and saddles at high points on piping to permit venting of air. Valves shall be capped after testing is completed.

H. Testing Specifics:

1. Water Transmission Mains:
 - a. Method: AWWA C600, as modified herein.
 - b. Duration: Four hours.
 - c. Pressure: 150 psi measured at lowest point of section of pipeline being tested.
 - d. Medium: Potable water.
 - e. Allowable Leakage: Leakage shall be defined as the quantity of test medium that must be added to the section of pipeline being tested to maintain the specified test pressure for the specified test duration. Maximum allowable leakage shall be as specified in AWWA C600.
2. Copper and Galvanized Steel Pipe:
 - a. Duration: Four hours.
 - b. Pressure: 150 psi.
 - c. Medium: Water.
 - d. Allowable Leakage: None.

3.8 DISINFECTION OF POTABLE WATER SYSTEMS

- A. Disinfect all water mains and interconnected piping after testing and before being placed into service to ensure their bacteriological safety. Disinfection shall be accomplished under the supervision of the Contractor by a person skilled and experienced in the operation of water systems. Following disinfection and flushing, the Contracting Officer will take water samples for bacteriological analysis of the water. If the specified bacteriological requirements are not satisfied, the disinfection procedure must be repeated until the requirements are met.
- B. Mains:
1. Standard: AWWA C651 as amended herein.
 2. Forms of Chlorine: Sodium hypochlorite or calcium hypochlorite.
 3. Method: Continuous-Feed.
- C. Small Pipelines (less than 3 inch):
1. Preparation: Provide the system with a 1-inch minimum service cock or valve or other means to inject chlorine solution at a point within 2 or 3 feet of its junction with the supply source. When system is complete thoroughly flush it by fully opening every outlet until clear water flows from all of them.
 2. Disinfecting Agent: Sodium hypochlorite or calcium hypochlorite in sufficient quantities to produce chlorine concentration of at least 50 parts per million in the system.
 3. Disinfecting Procedure:
 - a. Connect a hand-operated pump, or other means of injecting the disinfecting agent, to 1-inch minimum service cock or valve or other injection device. Pump must provide a pressure greater than that of supply of system.
 - b. With system completely full of water and supply valve open, proceed to adjust every outlet of system so that a trickle of water flows from each.
 - c. Inject disinfectant slowly and continuously at an even rate, not in slugs, until a test at each outlet shows a free chlorine residual concentration of at least 50 parts per million.
 - d. Close all outlets and valves, including valve connecting to supply line and 1-inch minimum service cock on solution injection connection. Maintain condition for 24 hours. After 24 hours test for residual chlorine at each outlet. The free residual chlorine concentration indicated should be not less than 10 ppm. If the indicated free chlorine concentration is less than 10 ppm, the disinfection procedure must be repeated until an approved result is obtained.
 4. When the above procedure has been completed to the satisfaction of the Contracting Officer, flush out entire system with fresh water until tests at all outlets show a residual of not more than 0.5 ppm.
- D. Chlorine Residual Testing: AWWA C651, Appendix A, DPD Drop Dilution Method, except where otherwise specified.
- E. Bacteriological Analyses of Water: After the completion of disinfecting procedure, including the final flushing as described

heretofore, the Contracting Officer will obtain water samples from this system for bacteriological analyses. Requirements for satisfactory disinfection of water supply are that bacteriological analyses (Heterotrophic plate count) indicate that water samples are negative for coliformmerogenes organisms, and that total plate count is less than 100 bacteria per cubic centimeter. If bacteriological analyses do not satisfy the above requirements, then disinfection procedure must be repeated until these requirements are met.

F. Disposal of Disinfection Solution: Dechlorinate and dispose of disinfection solution in accordance with applicable regulations. Take care to assure that chlorinated water is not spilled in drains.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02531

SANITARY SEWERS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 PIPE
 - 2.1.1 Plastic Pipe
 - 2.1.1.1 PVC Pipe
- 2.2 REQUIREMENTS FOR FITTINGS
 - 2.2.1 Fittings for Plastic Pipe
- 2.3 JOINTS
 - 2.3.1 Plastic Pipe Jointing
- 2.4 BRANCH CONNECTIONS
- 2.5 FRAMES AND COVERS
- 2.6 STEEL LADDER
- 2.7 CEMENT MORTAR
 - 2.7.1 Portland Cement
- 2.8 STRUCTURES
 - 2.8.1 Precast Reinforced Concrete Manhole Sections

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Pipe Laying
 - 3.1.1.1 Trenches
 - 3.1.1.2 Backfill
 - 3.1.1.3 Handling and Storage
 - 3.1.2 Leakage Tests
- 3.2 MANHOLE DETAILS
 - 3.2.1 General Requirements
 - 3.2.2 Steel Ladder Anchorage
 - 3.2.3 Jointing, Plastering and Sealing
 - 3.2.4 Setting of Frames and Covers
- 3.3 CLEANOUTS AND OTHER APPURTENANCES

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 02531

SANITARY SEWERS

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 74	(1998) Cast Iron Soil Pipe and Fittings
ASTM A 123/A 123M	(1997a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM C 14	(1995) Concrete Sewer, Storm Drain, and Culvert PipeASTM C 14M
	(1995) Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)ASTM C 33
	(1993) Concrete AggregatesASTM C 76
	(1998) Reinforced Concrete Culvert, Storm Drain, and Sewer PipeASTM C 76M
	(1998) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)ASTM C 94
	(1998) Ready-Mixed ConcreteASTM C 150
	(1997) Portland Cement
ASTM C 260	(1998) Air-Entraining Admixtures for ConcreteASTM C 270
	(1997a) Mortar for Unit Masonry
ASTM C 425	(1998) Compression Joints for Vitrified Clay Pipe and FittingsASTM C 443
	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber GasketsASTM
C 443M	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric)ASTM C 478
	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)ASTM C 564
	(1997) Rubber Gaskets for Cast Iron Soil Pipe and FittingsASTM C 700
	(1997) Vitrified Clay Pipe, Extra

ASTM C 828	Strength, Standard Strength, and Perforated (1998) Low-Pressure Air Test of Vitrified Clay Pipe LinesASTM C 924 (1989; R 1997) Concrete Pipe Sewer Lines by Low-Pressure Air Test MethodASTM C 972
ASTM D 412	(1995) Compression-Recovery of Tape Sealant (1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 624	(1991; R 1998) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D 1784	(1999) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2680	(1995a) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 2996	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) PipeASTM D 2997 (1995) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin) PipeASTM D 3034 (1998) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3262	(1996) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer PipeASTM D 3350 (1996) Polyethylene Plastics Pipe and Fittings MaterialsASTM D 3753 (1981; R 1991) Glass-Fiber-Reinforced Polyester ManholesASTM D 3840 (1988) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure ApplicationsASTM D 4161 (1996) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe Joints Using Flexible Elastomeric SealsASTM F 402 (1993) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

- ASTM F 477 (1996a) Elastomeric Seals (Gaskets) for Joining Plastic PipeASTM F 714
- 794 (1997) Polyethylene (PE) Plastic pipe (SDR-PR) Based on Outside DiameterASTM F (1997) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
- ASTM F 894 (1998) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain PipeASTM F 949 (1996a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings
- AMERICAN WATER WORKS ASSOCIATION (AWWA)AWWA C105
- (1993) Polyethylene Encasement for Ductile-Iron Pipe SystemsAWWA C110
- (1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other LiquidsAWWA C111
- (1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- AWWA C115 (1996) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
- AWWA C151 (1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
- NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
- NFPA 49 (1994) Hazardous Chemicals Data
- NFPA 325-1 (1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
- NFPA 704 (1996) Identification of the Fire Hazards of Materials for Emergency Response
- UNI-BELL PVC PIPE ASSOCIATION (UBPPA)
- UBPPA UNI-B-6 (1990) Recommended Practice for the Low-Pressure Air Testing of Installed Sewer Pipe
- UBPPA UNI-B-9 (1990; Addenda 1994) Recommended Performance Specification for Polyvinyl Chloride (PVC) Profile Wall Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter (Nominal Pipe Sizes 4-48 inch)

1.2 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and

building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Data; FIO

Submit data to show that the products specified in this Section conform to the Specifications requirements.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PVC Pipe

ASTM D 3034, Type PSM with a maximum SDR of 35, Size 15 inches or less in diameter. ASTM F 949 for corrugated sewer pipes with a smooth interior. UBPPA UNI-B-9 and ASTM F 794, Series 46, for ribbed sewer pipe with smooth interior, size 8 inch through 48 inch diameters. PVC shall be certified by the compounder as meeting the requirements of ASTM D 1784, cell Class 12454B. The pipe stiffness shall be greater than or equal to 735/D for cohesionless material pipe trench backfills.

2.2 REQUIREMENTS FOR FITTINGS

Fittings shall be compatible with the pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and other requirements specified below.

2.2.1 Fittings for Plastic Pipe

ABS and PVC composite sewer pipe fittings shall conform to ASTM D 2680.

2.3 JOINTS

Joints installation shall comply with the manufacturer's instructions.

2.3.1 Plastic Pipe Jointing

Flexible plastic pipe (PVC or high density polyethylene pipe) gasketed joints shall conform to ASTM D 3212.

2.4 BRANCH CONNECTIONS

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

2.5 FRAMES AND COVERS

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. Reinforced concrete frames and covers shall be as indicated or shall conform to ASTM C 478. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.6 STEEL LADDER

A steel ladder shall be provided where the depth of a manhole exceeds 12 feet. The ladder shall not be less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123/A 123M.

2.7 CEMENT MORTAR

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.7.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in manholes.

2.8 STRUCTURES

2.8.1 Precast Reinforced Concrete Manhole Sections

Precast reinforced concrete manhole sections shall conform to ASTM C 478,

except that portland cement shall be as specified herein. Joints shall be cement mortar, an approved mastic, rubber gaskets, a combination of these types; or the use of external preformed rubber joint seals and extruded rolls of rubber with mastic adhesive on one side.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Pipe Laying

- a. Pipe shall be protected during handling against impact shocks and free fall; the pipe interior shall be free of extraneous material.
- b. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. As the work progresses, the interior of the sewer shall be cleared of all superfluous materials.
- c. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.
- d. Installations of solvent weld joint pipe, using PVC pipe and fittings shall be in accordance with ASTM F 402. The Contractor shall ensure adequate trench ventilation and protection for workers installing the pipe.

3.1.1.1 Trenches

Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

3.1.1.2 Backfill

As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade. Plastic pipe shall be completely covered to prevent damage from ultraviolet light.

3.1.1.3 Handling and Storage

Pipe, fittings and joint material shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities for plastic pipe, fittings, joint materials and solvents shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49

and NFPA 325-1.

3.1.2 Leakage Tests

Lines shall be tested for leakage by low pressure air testing, infiltration tests or exfiltration tests, as appropriate. Low pressure air testing for PVC pipe shall be as prescribed in UBPPA UNI-B-6. Prior to infiltration or exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. When the Contracting Officer determines that infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed 25 gal per inch diameter per mile of pipeline per day. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Government.

3.2 MANHOLE DETAILS

3.2.1 General Requirements

Manholes shall be constructed of precast concrete manhole sections. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. Pipe connections shall be made to manhole using water stops, standard O-ring joints, special manhole coupling, or shall be made in accordance with the manufacturer's recommendation. The Contractor's proposed method of connection, list of materials selected, and specials required, shall be approved prior to installation. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot. Free drop inside the manholes shall not exceed 18 inches, measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels; drop manholes shall be constructed whenever the free drop would otherwise be greater than 1 foot 6 inches.

3.2.2 Steel Ladder Anchorage

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet apart vertically, and shall be installed to provide at least 6 inches of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

3.2.3 Jointing, Plastering and Sealing

Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Mortar and mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer. Precast rings may also be sealed by the use of extruded rolls of rubber with mastic adhesive on one side.

3.2.4 Setting of Frames and Covers

Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 2 inches higher than finished grade in unpaved areas. Frame and cover assemblies shall be sealed to manhole sections using external preformed rubber joint seals that meet the requirements of ASTM D 412 and ASTM D 624, or other methods specified in paragraph Jointing, Plastering and Sealing, unless otherwise specified.

3.3 CLEANOUTS AND OTHER APPURTENANCES

Cleanouts and other appurtenances shall be installed where shown on the drawings or as directed by the Contracting Officer, and shall conform to the details on the drawings.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02630

STORM-DRAINAGE SYSTEM

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING
 - 1.3.1 Delivery and Storage
 - 1.3.2 Handling

PART 2 PRODUCTS

- 2.1 PIPE FOR CULVERTS AND STORM DRAINS
 - 2.1.1 Corrugated Steel Pipe
- 2.2 DRAINAGE STRUCTURES
 - 2.2.1 Flared End Sections
- 2.3 MISCELLANEOUS MATERIALS
 - 2.3.1 Joints
 - 2.3.1.1 Flexible Watertight, Gasketed Joints

PART 3 EXECUTION

- 3.1 EXCAVATION FOR PIPE CULVERTS AND STORM DRAINS
 - 3.1.1 Trenching
 - 3.1.2 Removal of Unstable Material
- 3.2 BEDDING
 - 3.2.1 Corrugated Metal Pipe
- 3.3 PLACING PIPE
 - 3.3.1 Corrugated Metal Pipe and Pipe Arch
- 3.4 JOINTING
 - 3.4.1 Corrugated Metal Pipe
 - 3.4.1.1 Field Joints
 - 3.4.1.2 Flexible Watertight, Gasketed Joints
- 3.5 BACKFILLING
 - 3.5.1 Backfilling Pipe in Trenches
 - 3.5.2 Movement of Construction Machinery
 - 3.5.3 Compaction
- 3.6 PIPELINE TESTING

-- End of Section Table of Contents --

SECTION 02630

STORM-DRAINAGE SYSTEM

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 346/346R (1990) Standard Specification for
Cast-in-Place Nonreinforced Concrete Pipe
and Recommendations

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO HB-16 (1996) Standard Specifications for Highway
Bridges

AASHTO M 167 (1994) Corrugated Steel Structural Plate,
Zinc Coated, for Field Bolted Pipe

AASHTO M 190 (1995) Bituminous Coated Corrugated Metal
Culvert Pipe and Pipe Arches

AASHTO M 198 (1998) Joints for Circular Concrete Sewer
and Culvert Pipe Using Flexible Watertight
Gaskets

AASHTO M 219 (1992; R 1995) Aluminum Alloy Structural
Plate for Field Bolted Conduits

AASHTO M 243 (1996) Field Applied Coating of Corrugated
Metal Structural Plate for Pipe,
Pipe-Arches, and Arches

AASHTO M 294 (1998) Corrugated Polyethylene Pipe, 300-
to 1200- mm Diameter

AASHTO MP7 (1997) Corrugated Polyethylene Pipe, 1350
and 1500 mm Diameter

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION
(AREMA)

AREMA Manual (1999) Manual for Railway Engineering (4 Vol.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994a) Gray Iron Castings
ASTM A 48M	(1994 el) Gray Iron Castings (Metric)
ASTM A 123/A 123M	(1997ael) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 536	(1999el) Ductile Iron Castings
ASTM A 716	(1995) Ductile Iron Culvert Pipe
ASTM A 742/A 742M	(1998) Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe
ASTM A 760/A 760M	(1997) Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM A 762/A 762M	(1998) Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A 798/A 798M	(1997a) Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
ASTM A 807	(1997) Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications
ASTM A 849	(1997) Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
ASTM A 929/A 929M	(1997) Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
ASTM B 26/B 26M	(1998) Aluminum-Alloy Sand Castings
ASTM B 745/B 745M	(1997) Corrugated Aluminum Pipe for Sewers and Drains
ASTM C 12	(1998el) Installing Vitrified Clay Pipe Lines
ASTM C 14	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 14M	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)

ASTM C 32	(1999e1) Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C 55	(1999) Concrete Brick
ASTM C 62	(1997a) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 76	(1999) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 76M	(1999a) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 139	(1999) Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(1997) Mortar for Unit Masonry
ASTM C 425	(1998b) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 443M	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric)
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C 506	(1999) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C 506M	(1999) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 507	(1999) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
ASTM C 507M	(1999) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 655	(1995a) Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe

ASTM C 700	(1999) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 789	(1998) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
ASTM C 828	(1998) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 850	(1998) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 ft. of Cover Subjected to Highway Loadings
ASTM C 877	(1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 877M	(1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
ASTM C 923	(1998) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Materials
ASTM C 924	(1998) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 924M	(1998) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method (Metric)
ASTM C 1103	(1994) Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 1103M	(1994) Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)
ASTM D 1056	(1998) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1171	(1994) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 1751	(1999) Preformed Expansion Joint Filler

	for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2321	(1989; R 1995) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3034	(1998) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3350	(1998a) Polyethylene Plastics Pipe and Fittings Materials
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 679	(1995) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F 714	(1997) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F 794	(1999) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 894	(1998a) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F 949	(1999) Poly(Vinyl Chloride) (PVC)

Corrugated Sewer Pipe with a Smooth
Interior and Fittings

ASTM F 1417

(1992; R 1998) Installation Acceptance of
Plastic Gravity Sewer Lines Using
Low-Pressure Air

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Data; FIO.

Printed copies of the manufacturer's data for pipe and joints.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Corrugated Steel Pipe

ASTM A 760/A 760M, zinc or aluminum (Type 2) coated pipe of:

- a. Type II pipe with helical 2-2/3 by 1/2 inch corrugations.

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A 929/A 929M.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Joints

2.3.1.1 Flexible Watertight, Gasketed Joints

- a. Gaskets: When infiltration or exfiltration is a concern for pipe lines, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band approximately 7 inches wide and approximately 3/8 inch thick, meeting the requirements of ASTM D 1056, Type 2, and shall have a quality retention rating of not less than 70 percent when tested for weather resistance by ozone chamber exposure, Method B of ASTM D 1171. Rubber O-ring gaskets shall be 13/16 inch in diameter for pipe diameters of 36 inches or smaller and 7/8 inch in diameter for larger pipe having 1/2 inch deep end corrugation. Rubber O-ring gaskets shall be 1-3/8 inches in diameter for pipe having 1 inch deep end corrugations. O-rings shall meet the requirements of AASHTO M 198 or ASTM C 443. Flexible plastic gaskets shall conform to requirements of AASHTO M 198, Type B.
- b. Connecting Bands: Connecting bands shall be of the type, size and sheet thickness of band, and the size of angles, bolts, rods and lugs as indicated or where not indicated as specified in the applicable standards or specifications for the pipe. Exterior rivet heads in the longitudinal seam under the connecting band shall be countersunk or the rivets shall be omitted and the seam welded.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS AND STORM DRAINS

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 02300 "Earthwork" and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 18 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheet piling and bracing, where required, shall be placed within the trench width as specified. Contractor shall not overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary.

Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered

in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Corrugated Metal Pipe

Bedding for corrugated metal pipe and pipe arch shall be in accordance with ASTM A 798/A 798M. It is not required to shape the bedding to the pipe geometry. However, for pipe arches, the Contractor shall either shape the bedding to the relatively flat bottom arc or fine grade the foundation to a shallow v-shape. Bedding for corrugated structural plate pipe shall meet requirements of ASTM A 807.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Corrugated Steel and Aluminum Alloy	5

Not less than 30 days after the completion of backfilling, the Contracting Officer may perform a deflection test on the entire length of installed flexible pipe using a mandrel or other suitable device. Installed flexible pipe showing deflections greater than those indicated above shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

3.3.1 Corrugated Metal Pipe and Pipe Arch

Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Part paved pipe shall be installed so that

the centerline of bituminous pavement in the pipe, indicated by suitable markings on the top at each end of the pipe sections, coincides with the specified alignment of pipe. Fully paved steel pipe or pipe arch shall have a painted or otherwise applied label inside the pipe or pipe arch indicating sheet thickness of pipe or pipe arch. Any unprotected metal in the joints shall be coated with bituminous material as specified in AASHTO M 190 or AASHTO M 243. Interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During transportation and installation, pipe or pipe arch and coupling bands shall be handled with care to preclude damage to the coating, paving or lining. Damaged coatings, pavings and linings shall be repaired in accordance with the manufacturer's recommendations prior to placing backfill. Pipe on which coating, paving or lining has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced. Vertical elongation, where indicated, shall be accomplished by factory elongation. Suitable markings or properly placed lifting lugs shall be provided to ensure placement of factory elongated pipe in a vertical plane.

3.4 JOINTING

3.4.1 Corrugated Metal Pipe

3.4.1.1 Field Joints

Transverse field joints shall be designed so that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A 798/A 798M. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. The annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 30 inches or larger, shall be filled with a bituminous material after jointing. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

3.4.1.2 Flexible Watertight, Gasketed Joints

Installation shall be as recommended by the gasket manufacturer for use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same

pipe. When the adjoining section of pipe is in place, the doubled-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so that the gasket covers the end of pipe sections equally. Connecting bands shall be centered over adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. Band Tightening: The band shall be tightened evenly, even tension being kept on the rods or bolts, and the gasket; the gasket shall seat properly in the corrugations. Watertight joints shall remain uncovered for a period of time designated, and before being covered, tightness of the nuts shall be measured with a torque wrench. If the nut has tended to loosen its grip on the bolts or rods, the nut shall be retightened with a torque wrench and remain uncovered until a tight, permanent joint is assured.

3.5 BACKFILLING

3.5.1 Backfilling Pipe in Trenches

(Refer to Section 02300, 3.8.1)

3.5.2 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.5.3 Compaction

(Refer to Section 02300, 3.10.1)

3.6 PIPELINE TESTING

Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate. Low pressure air testing for concrete pipes shall conform to ASTM C 924. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C 828 or ASTM C 924, after consultation with the pipe manufacturer.

Testing of individual joints for leakage by low pressure air or water shall conform to ASTM C 1103. Prior to exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection.

Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established. The amount of water required

to maintain this water level during a 2-hour test period shall be measured.

Leakage as measured by the exfiltration test shall not exceed 0.2 gallons per inch in diameter per 100 feet of pipeline per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correcting, and retesting shall be made at no additional cost to the Government.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02705

PAVING AND RESURFACING

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUMMARY
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
- 1.5 REGULATORY REQUIREMENTS

PART 2 PRODUCTS

- 2.1 PAVING MATERIALS
- 2.2 HEADERS
- 2.3 PAVEMENT PAINT

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 PAVEMENT CUTTING
- 3.3 PLACEMENT OF AGGREGATE BASE
- 3.4 ASPHALT CONCRETE INSTALLATION
- 3.5 ASPHALT CONCRETE TESTING
- 3.6 PAVEMENT MARKINGS
- 3.7 HEADERS

-- End of Section Table of Contents --

SECTION 02705

PAVING AND RESURFACING
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

Whenever the words "Standard Specifications" are referred to, the reference is to the State of California, Department of Transportation, Standard Specifications.

American Society for Testing and Materials (ASTM)

ASTM D 1556	Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2922	Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Method (Shallow Depth)

1.2 SUMMARY

A. Section Includes: Furnishing all labor, material, equipment, tools and services required for the placing and compacting of asphalt concrete pavement and aggregate surfacing for roadways, parking lots and walkways to the lines, grades and dimensions shown on the Drawings and as specified herein. Also included is the repair and resurfacing of existing roadway and area paving damaged or removed during construction.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Mix Certificate; FIO.

Submit a batch plant mix certificate from each source of supply for each construction material employed on this project indicating that the materials meet the Specification requirements.

1.4 QUALITY ASSURANCE

Comply with "Standard Specifications" of State of California, Department of Transportation (CALTRANS).

1.5 REGULATORY REQUIREMENTS

All work, material, procedures and practices under this Section shall conform with requirements of the California Air Resources Board (CARB) and the Air Pollution Control District having jurisdiction.

PART 2 PRODUCTS

2.1 PAVING MATERIALS

A. Aggregate Base: Standard Specifications, Section 26. Class and size as indicated on the Drawings; or if not indicated on the Drawings, use Class 2, 3/4-inch maximum.

B. Tack Coat and Seal Coat: Emulsified asphalt, Grade SS-1 or SS-1h, Standard Specifications, Section 94.

C. Asphalt Concrete: Type B, 1/2-inch maximum, medium grading, Standard Specification Section 39. Bitumin ratio shall be selected by the supplier in accordance with paragraph 39-2.02 of the Standard Specifications.

2.2 HEADERS

A. At straight sections, wood headers shall be constructed of 2-inch x 6-inch construction heart redwood, held in place by 2-inch x 4-inch stakes, of the same materials, 2 feet long and set at 8-foot centers.

B. At curved sections, wood headers shall be constructed of three 1/2-inch x 4-inch construction heart redwood bender boards. Boards shall be lapped at one-third of the length of individual boards, with no two boards lapped at the same place. Hold boards in place with stakes same as above.

2.3 PAVEMENT PAINT

Comply with Section 84-3.02 of the Standard Specifications.

PART 3 EXECUTION

3.1 GENERAL

A. This Specification shall cover newly surfaced areas as well as restoration of existing surfacing.

- B. Adjust existing and new manholes, meter boxes, cleanouts, etc. to match the new grade.

3.2 PAVEMENT CUTTING

After backfilling trenches and prior to paving, saw cut existing pavement parallel to the trench (using a concrete saw) to a minimum depth equal to or greater than one-half the thickness thereof. The pavement shall be cut back 6 inches on each side of the trench or excavation wall. Re-cut and restore any pavement damaged outside these lines at the expense of the Contractor. Should voids develop under the existing pavements during construction, those affected pavements shall be neatly saw cut in straight lines and replaced after the voids have been filled.

3.3 PLACEMENT OF AGGREGATE BASE

- A. Subgrade Preparation: Water or dry subgrade as required to bring the soil to at least 3% above the optimum moisture content for proper compacting. Compact to a relative compaction of not less than 95% in the upper 6 inches. When compaction of the subgrade areas on fill and embankments has been properly obtained, only such additional rolling will be required as necessary to obtain a thoroughly compacted subgrade immediately prior to placing the aggregate base thereon.
- B. Aggregate Base Tolerance: Do not place the aggregate base before the subgrade is approved by the Contracting Officer. The finished aggregate base shall not vary more than 0.05 foot above, nor 0.10 foot below, the planned grade.
- C. Aggregate Base Placing: Spread the aggregate base material on the prepared subgrade by means of suitable spreading devices. The aggregate base material may be dumped in piles upon the subgrade and spread by bulldozing ahead from the dumped material. Each layer shall not exceed 0.50 feet. Segregation of large or fine particles of aggregate shall be avoided, and the material as spread shall be free from pockets of large and fine material.
- D. Compaction: Laboratory maximum density and optimum moisture shall be determined by ASTM D 1557, Method C. Compact each layer of aggregate base material to not less than 98% relative compaction as determined by ASTM D 1556 (Sand Cone), or ASTM D 2922 (Nuclear method when approved by the Contracting Officer). Compaction shall be in accordance with Section 26-1.05 of the Standard Specifications. Water aggregate base after compaction as provided in Section 17 of the Standard Specifications. Paragraph 17-1.04 is not applicable.

3.4 ASPHALT CONCRETE INSTALLATION

- A. Apply tack coat at a rate of 0.05-gallon per square yard and apply along vertical edge of cut pavement.
- B. Spread and compact asphalt concrete in accordance with Standard Specifications Section 39 to the thickness shown on the Drawings. Asphalt concrete shall be compacted to not less than 95% of the laboratory maximum

density.

C. Protect asphaltic concrete paving until surface has cooled sufficiently to permit traffic without damage.

D. Immediately remove spilled and splattered materials from adjacent surfaces.

3.5 ASPHALT CONCRETE TESTING

The Contractor is responsible for asphalt concrete testing. Requirements of testing shall be in accordance with Construction Control Manual (CESPK PAM 415-1-2).

3.6 PAVEMENT MARKINGS

A. Replace existing pavement markings that are removed or damaged by the construction.

B. Apply pavement markings in accordance with Section 84 of the Standard Specifications.

3.7 HEADERS

Install wood headers along pavement edges where indicated on the Drawings. Install new headers where existing wood headers are damaged during construction, or removed for construction. Install headers with uniform slope between spot elevation indicated on the Drawings or to conform to existing grades.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02821

FENCING

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS

PART 2 PRODUCTS

- 2.1 FENCE FABRIC
 - 2.1.1 Chain Link Fence Fabric
- 2.2 GATES
- 2.3 POSTS
 - 2.3.1 Metal Posts for Chain Link Fence
- 2.4 BRACES AND RAILS
- 2.5 WIRE
 - 2.5.1 Tension Wire
 - 2.5.2 Barbed Wire
 - 2.5.3 Tie Wire
- 2.6 ACCESSORIES
- 2.7 SLATS
- 2.8 CONCRETE
- 2.9 PADLOCKS

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 EXCAVATION
- 3.3 POST INSTALLATION
 - 3.3.1 Posts for Chain Link Fence
- 3.4 RAILS
 - 3.4.1 Top Rail
 - 3.4.2 Bottom Rail
- 3.5 BRACES AND TRUSS RODS
- 3.6 TENSION WIRES
- 3.7 CHAIN LINK FABRIC
- 3.8 BARBED WIRE SUPPORTING ARMS AND BARBED WIRE
 - 3.8.1 General Requirements
- 3.9 GATE INSTALLATION
- 3.10 GROUNDING

-- End of Section Table of Contents --

SECTION 02821

FENCING

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	Specification for Pipe, Steel Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 116	(1995) Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
ASTM A 121	(1992a) Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A 153/A 153M	(1998) Zinc-Coated (Hot Dip) on Iron and Steel Hardware
ASTM A 176	(1997) Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
ASTM A 392	(1996) Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A 478	(1997) Chromium-Nickel Stainless and Heat-Resisting Steel Weaving and Knitting Wire
ASTM A 491	(1996) Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A 585	(1997) Aluminum-Coated Steel Barbed Wire
ASTM A 666	(1996b) Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
ASTM A 702	(1989; R 1994) Steel Fence Posts and Assemblies, Hot Wrought

ASTM A 780	(1993a) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM A 824	(1995) Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence
ASTM C 94	(1998) Ready-Mixed Concrete
ASTM D 4541	(1995) Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM F 626	(1996) Fence Fittings
ASTM F 668	(1996) Poly(Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric
ASTM F 883	(1997) Padlocks
ASTM F 900	(1994) Industrial and Commercial Swing Gates
ASTM F 1043	(1998a) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework
ASTM F 1083	(1997) Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F 1184	(1994) Industrial and Commercial Horizontal Slide Gates
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM G 26	(1996) Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM G 53	(1996) Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-1 Data

Chain Link Fence; FIO.

Submit complete descriptive information and technical specifications on the chain link fence, gates, and appurtenances.

PART 2 PRODUCTS

2.1 FENCE FABRIC

Fence fabric shall conform to the following:

2.1.1 Chain Link Fence Fabric

ASTM A 392, Class 1, zinc-coated steel wire with minimum coating weight of 1.2 ounces of zinc per square foot of coated surface. Fabric shall be fabricated of 9 gauge wire woven in 2 inch mesh. Fabric height shall be 6 feet. Fabric shall be twisted and barbed on the top selvage and knuckled on the bottom selvage.

2.2 GATES

Gates shall be installed in the sizes and at the locations as shown on the Drawings.

Swinging Gates: ASTM F 900 and/or ASTM F 1184. Gate frames shall conform to strength and coating requirements of ASTM F 1083 for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2. Gate frames shall conform to strength and coating requirements of ASTM F 1043, for Group IC, steel pipe with external coating Type A or Type B, nominal pipe size (NPS) 1-1/2. Gate fabric shall be as specified for chain link fabric. Gate leaves more than 8 feet wide shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 8 feet wide shall have truss rods or intermediate braces. Intermediate braces shall be provided on all gate frames with an electro-mechanical lock. Gate fabric shall be attached to the gate frame by method standard with the manufacturer except that welding will not be permitted. Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gate. Latches shall be arranged for padlocking so that the padlock will be accessible from both sides of the gate. Stops shall be provided for holding the gates in the open position. For high security applications, each end member of gate frames shall be extended sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence.

Rolling Gates: All gate frames shall have 1-inch Schedule 40 steel pipe diagonal braces inside each gate panel. Diagonal braces shall be installed such that the high end of the braces shall be toward the forward end of the gate as the gate rolls closed (i.e., high end of the braces toward the end of the gate that rolls on the ground and low end of the braces toward the end of the gate that is supported on the adjacent stationary fence). Gates shall have two wheels that travel on two 1-1/4-inch-diameter Schedule 40 galvanized steel pipe guide rails attached to the adjacent stationary fence. These rails shall have stops to prevent the gate wheels from

rolling off the back end of the rails when the gate is fully opened. The opposite end of the gate shall have two 8-inch rubber wheels on grade.

2.3 POSTS

2.3.1 Metal Posts for Chain Link Fence

ASTM F 1083, zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or Type B and Group II, formed steel sections, shall meet the strength and coating requirements of ASTM F 1043. Group III, ASTM F 1043 steel H-section may be used for line posts in lieu of line post shapes specified for the other classes. Sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate post shall be for the gate type specified subject to the limitation specified in ASTM F 900 and/or ASTM F 1184.

2.4 BRACES AND RAILS

ASTM F 1083, zinc-coated, Group IA, steel pipe, size NPS 1-1/4. Group IC steel pipe, zinc-coated, shall meet the strength and coating requirements of ASTM F 1043. Group II, formed steel sections, size 1-21/32 inch, conforming to ASTM F 1043, may be used as braces and rails if Group II line posts are furnished.

2.5 WIRE

2.5.1 Tension Wire

Tension wire shall be Type I or Type II, Class 2 coating, in accordance with ASTM A 824.

2.5.2 Barbed Wire

Barbed wire shall be 2 strand, 12-1/2 gauge wire, zinc-coated, Class 3 in accordance with ASTM A 121 or aluminum coated Type I in accordance with ASTM A 585. Barbed wire shall be four-point barbed type steel wire. Barbed wire support arms shall be the V arm type and of the design required for the post furnished.

2.5.3 Tie Wire

Tie wire for attaching fabric to rails, braces, and posts shall be 9 gauge steel wire and match the coating of the fence fabric. Miscellaneous hardware coatings shall conform to ASTM A 153/A 153M unless modified.

2.6 ACCESSORIES

ASTM F 626. Ferrous accessories shall be zinc or aluminum coated. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment.

2.7 SLATS

Slats shall be high density polyethylene containing color pigmentation and U.V. inhibitors to resist the effects of ultra violet radiation from sunlight. Slats shall be installed in the chain link fabric wire where shown on the Drawings. Slats shall be in lengths to equal the fence height.

2.8 CONCRETE

ASTM C 94, using 3/4 inch maximum size aggregate, and having minimum compressive strength of 3000 psi at 28 days. Grout shall consist of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

2.9 PADLOCKS

Padlocks shall conform to ASTM F 883, Type P01, Option A , Size 1-3/4 inch. Provide total of three padlocks for the project. All padlocks shall be keyed alike. The padlocks will be installed at the gates of the water treatment plant.

PART 3 EXECUTION

3.1 INSTALLATION

Fence shall be installed to the lines and grades indicated. The area on either side of the fence line shall be cleared to the extent indicated. Line posts shall be spaced equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 500 feet. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A 780.

3.2 EXCAVATION

Post holes shall be cleared of loose material. Waste material shall be spread where directed. The ground surface irregularities along the fence line shall be eliminated to the extent necessary to maintain a 1 inch clearance between the bottom of the fabric and finish grade.

3.3 POST INSTALLATION

3.3.1 Posts for Chain Link Fence

Posts shall be set plumb and in alignment. Except where solid rock is encountered, posts shall be set in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, posts shall be set to a minimum depth of 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, posts shall be set to the minimum depth indicated on the drawing unless a penetration of 18 inches in solid rock is achieved before reaching the indicated depth, in which case depth of penetration shall terminate. All portions of posts set in rock shall be grouted. Portions of posts not set in rock shall be set in concrete from the rock to ground level. Posts set in concrete shall be set

in holes not less than the diameter shown on the drawings. Diameters of holes in solid rock shall be at least 1 inch greater than the largest cross section of the post. Concrete and grout shall be thoroughly consolidated around each post, shall be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure for 72 hours prior to attachment of any item to the posts. Group II line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Driven posts shall be set to a minimum depth of 3 feet and shall be protected with drive caps when being set. For high security fences, fence post rigidity shall be tested by applying a 50 pound force on the post, perpendicular to the fabric, at 5 feet above ground; post movement measured at the point where the force is applied shall be less than or equal to 3/4 inch from the relaxed position; every tenth post shall be tested for rigidity; when a post fails this test, further tests on the next four posts on either side of the failed post shall be made; all failed posts shall be removed, replaced, and retested at the Contractor's expense.

3.4 RAILS

3.4.1 Top Rail

Top rail shall be supported at each post to form a continuous brace between terminal posts. Where required, sections of top rail shall be joined using sleeves or couplings that will allow expansion or contraction of the rail. Top rail, if required for high security fence, shall be installed as indicated on the drawings.

3.4.2 Bottom Rail

The bottom rail shall be bolted to double rail ends and double rail ends shall be securely fastened to the posts. Bolts shall be peened to prevent easy removal. Bottom rail shall be installed before chain link fabric.

3.5 BRACES AND TRUSS RODS

Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal (compression) braces and diagonal truss (tension) rods shall be installed on fences over 6 feet in height. A center brace or 2 diagonal truss rods shall be installed on 12 foot fences. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal. No bracing is required on fences 6 feet high or less if a top rail is installed.

3.6 TENSION WIRES

Tension wires shall be installed along the top and bottom of the fence line and attached to the terminal posts of each stretch of the fence. Top tension wires shall be installed within the top 4 inches of the installed fabric. Bottom tension wire shall be installed within the bottom 6 inches of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

3.7 CHAIN LINK FABRIC

Chain link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15 inch intervals. The fabric shall be installed and pulled taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fabric shall be fastened to line posts at approximately 15 inch intervals and fastened to all rails and tension wires at approximately 24 inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be 1 plus or minus 1/2 inch above the ground. For high security fence, after the fabric installation is complete, the fabric shall be exercised by applying a 50 pound push-pull force at the center of the fabric between posts; the use of a 30 pound pull at the center of the panel shall cause fabric deflection of not more than 2-1/2 inches when pulling fabric from the post side of the fence; every second fence panel shall meet this requirement; all failed panels shall be resecured and retested at the Contractor's expense.

3.8 BARBED WIRE SUPPORTING ARMS AND BARBED WIRE

3.8.1 General Requirements

Barbed wire supporting arms and barbed wire shall be installed as indicated and as recommended by the manufacturer. Supporting arms shall be anchored to the posts in a manner to prevent easy removal with hand tools. Barbed wire shall be pulled taut and attached to the arms with clips or other means that will prevent easy removal.

3.9 GATE INSTALLATION

Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Rolling gates shall be installed as recommended by the manufacturer. Padlocks shall be attached to gates or gate posts with chains. Hinge pins, and hardware shall be welded or otherwise secured to prevent removal.

3.10 GROUNDING

Fences shall be grounded on each side of all gates, at each corner, at the closest approach to each building located within 50 feet of the fence, and where the fence alignment changes more than 15 degrees. Grounding locations shall not exceed 650 feet. Each gate panel shall be bonded with a flexible bond strap to its gate post. Fences crossed by powerlines of 600 volts or more shall be grounded at or near the point of crossing and at distances not exceeding 150 feet on each side of crossing. Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be 3/4 inch by 10 foot long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable, electrodes shall be buried a minimum of 12 inches deep and radially from

the fence. The top of the electrode shall be not less than 2 feet or more than 8 feet from the fence. Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. After installation the total resistance of fence to ground shall not be greater than 25 ohms.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02930

EXTERIOR PLANTING

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 SOURCE INSPECTIONS
- 1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING
 - 1.4.1 Delivery
 - 1.4.1.1 Plant Material Identification
 - 1.4.1.2 Protection During Delivery
 - 1.4.1.3 Delivered Topsoil
 - 1.4.1.4 Soil Amendments
 - 1.4.2 Inspection
 - 1.4.3 Storage
 - 1.4.3.1 Plant Material Storage
 - 1.4.3.2 Other Material Storage
 - 1.4.4 Handling
 - 1.4.5 Time Limitation
- 1.5 WARRANTY

PART 2 PRODUCTS

- 2.1 PLANT MATERIAL
 - 2.1.1 Plant Material Classification
 - 2.1.2 Plant Schedule
 - 2.1.3 Substitutions
 - 2.1.4 Quality
 - 2.1.5 Growing Conditions
 - 2.1.6 Method of Shipment to Maintain Health of Root System
 - 2.1.6.1 Balled and Burlapped (BB) Plant Material
 - 2.1.6.2 Balled and Potted (Pot) Plant Material
 - 2.1.6.3 Balled and Platform (BP) Plant Material
 - 2.1.6.4 Bare-Root (BR) Plant Material
 - 2.1.6.5 Container-Grown (C) Plant Material
 - 2.1.7 Growth of Trunk and Crown
 - 2.1.7.1 Deciduous Trees
 - 2.1.7.2 Coniferous Evergreen Plant Material
 - 2.1.8 Plant Material Size
- 2.2 TOPSOIL
- 2.3 SOIL AMENDMENTS
 - 2.3.1 Fertilizer
- 2.4 MULCH

- 2.4.1 Organic Mulch
 - 2.4.1.1 Recycled Mulch
 - 2.4.1.2 Shredded Bark
 - 2.4.1.3 Wood Chips and Ground Bark
- 2.5 GEOTEXTILE
- 2.6 WOOD STAKING MATERIAL
 - 2.6.1 Bracing Stake
- 2.7 TREE ROOT BARRIERS

PART 3 EXECUTION

- 3.1 SITE PREPARATION
 - 3.1.1 Finished Grade, Topsoil and Underground Utilities
 - 3.1.2 Layout
 - 3.1.3 Protecting Existing Vegetation
- 3.2 EXCAVATION
 - 3.2.1 Obstructions Below Ground
 - 3.2.2 Turf Removal
 - 3.2.3 Plant Pits
- 3.3 INSTALLATION
 - 3.3.1 Setting Plant Material
 - 3.3.1.1 Bare-Root Plant Material
 - 3.3.2 Tree Root Barrier
 - 3.3.3 Backfill Soil Mixture
 - 3.3.4 Backfill Procedure
 - 3.3.4.1 Balled and Burlapped, and Balled and Platformed Plant Material
 - 3.3.4.2 Bare-Root Plant Material
 - 3.3.4.3 Container-Grown and Balled and Potted Plant Material
 - 3.3.4.4 Earth Berm
 - 3.3.5 Plant Bed
 - 3.3.6 Watering
 - 3.3.7 Staking and Guying
 - 3.3.7.1 One Bracing Stake
 - 3.3.7.2 Two Bracing Stakes
- 3.4 FINISHING
 - 3.4.1 Plant Material
 - 3.4.2 Placing Geotextile
 - 3.4.3 Placing Mulch
 - 3.4.4 Pruning
- 3.5 MAINTENANCE DURING PLANTING OPERATION
- 3.6 RESTORATION AND CLEAN UP
 - 3.6.1 Restoration
 - 3.6.2 Clean Up

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 02930

EXTERIOR PLANTING

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)

ANLA ANSI/ANLA Z60.1 (1996) Nursery Stock

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300 (1995) Tree Care Operations - Trees, Shrubs and other Woody Plant Maintenance

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602 (1995a) Agricultural Liming Materials

ASTM D 4972 (1995a) pH of Soils

ASTM D 5034 (1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)

ASTM D 5035 (1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)

ASTM D 5268 (1992; R1996) Topsoil Used for Landscaping Purposes

ASTM D 5883 (1996) Standard Guide for Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Soil Test Data: FIO

Submit soil test for delivered topsoil.

SD-13 Certificates

Source Quality Control; FIO

Submit written certifications stating all amendments, top soil conform to the specification requirements.

1.3 SOURCE INSPECTIONS

The nursery or source of plant material and the source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.4.1.1 Plant Material Identification

Plant material shall be identified with attached, durable, waterproof labels and weather-resistant ink, stating the correct botanical plant name and size.

1.4.1.2 Protection During Delivery

Plant material shall be protected during delivery to prevent desiccation and damage to the branches, trunk, root system, or earth ball. Branches shall be protected by tying-in. Exposed branches shall be covered during transport.

1.4.1.3 Delivered Topsoil

Prior to the delivery of any topsoil, the availability of topsoil shall be verified in paragraph TOPSOIL. A soil test shall be provided for delivered topsoil.

1.4.1.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis.

1.4.2 Inspection

Plant material shall be well shaped, vigorous and healthy with a healthy, well branched root system, free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement or abrasion. Plant material shall be

checked for unauthorized substitution and to establish nursery grown status. Plant material showing desiccation, abrasion, sun-scald injury, disfigurement, or unauthorized substitution shall be rejected. The plant material shall exhibit typical form of branch to height ratio; and meet the caliper and height measurements specified. Plant material that measures less than specified, or has been poled, topped off or headed back, shall be rejected. Container-grown plant material shall show new fibrous roots and the root mass shall contain its shape when removed from the container. Plant material with broken or cracked balls; or broken containers shall be rejected. Bare-root plant material that is not dormant or is showing roots were pulled from the ground shall be rejected. Other materials shall be inspected for compliance with paragraph PRODUCTS. Open soil amendment containers or wet soil amendments shall be rejected. Topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material larger than 1-1/2 inch diameter shall be rejected. Topsoil that contains viable plant material and plant parts shall be rejected. Unacceptable material shall be removed from the job site.

1.4.3 Storage

1.4.3.1 Plant Material Storage

Plant material not installed on the day of arrival at the site shall be stored and protected in designated areas. Plant material shall not be stored longer than 30 days. Plant material shall be protected from direct exposure to wind and sun. Bare-root plant material shall be heeled-in. All plant material shall be kept in a moist condition by watering with a fine mist spray until installed.

1.4.3.2 Other Material Storage

Storage of other material shall be in designated areas. Soil amendments shall be stored in dry locations and away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with planting operation material.

1.4.4 Handling

Plant material shall not be injured in handling. Cracking or breaking the earth ball of balled and burlapped plant material shall be avoided. Plant material shall not be handled by the trunk or stems. Materials shall not be dropped from vehicles.

1.4.5 Time Limitation

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum 24 hours.

1.5 WARRANTY

Trees in 15-gallon can or larger shall be in thriving condition 1 year from the date of final acceptance, shrubs for 6 months from date of acceptance.

Plant maintenance shall be for 60 days from the date of acceptance. Ground cover and shrub areas shall be weeded and dead plants replaced at 30 day intervals for 60 days.

PART 2 PRODUCTS

2.1 PLANT MATERIAL

2.1.1 Plant Material Classification

The plant material shall be nursery grown stock conforming to ANLA ANSI/ANLA Z60.1 and shall be the species specified.

2.1.2 Plant Schedule

The plant schedule shall provide botanical names as included in one or more of the publications listed under "Nomenclature" in ANLA ANSI/ANLA Z60.1.

2.1.3 Substitutions

Substitutions will not be permitted without written request and approval from the Contracting Officer.

2.1.4 Quality

Well shaped, well grown, vigorous plant material having healthy and well branched root systems in accordance with ANLA ANSI/ANLA Z60.1 shall be provided. Plant material shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems, which may occur from the digging and preparation for shipment, method of shipment, or shipment. Plant quality is determined by the growing conditions; method of shipment to maintain health of the root system; and growth of the trunk and crown as follows.

2.1.5 Growing Conditions

Plant material shall be native to or well-suited to the growing conditions of the project site. Plant material shall be grown under climatic conditions similar to those at the project site.

2.1.6 Method of Shipment to Maintain Health of Root System

2.1.6.1 Balled and Burlapped (BB) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with biodegradable twine.

2.1.6.2 Balled and Potted (Pot) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be done by hand digging or mechanical devices. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. Container shall be used to retain the ball unbroken. Container shall be rigid to hold ball shape and protect root mass during shipping.

2.1.6.3 Balled and Platform (BP) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. Plants shall be prepared as balled and burlapped plant material and securely fastened to wood platform for shipping.

2.1.6.4 Bare-Root (BR) Plant Material

Minimum root spread shall be in accordance with ANLA ANSI/ANLA Z60.1. A well branched root system characteristic of the species specified shall be provided. Roots shall not be pulled from the ground. Bare-root plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. Bare-root plant material shall be dormant. The root system shall be protected from drying out.

2.1.6.5 Container-Grown (C) Plant Material

Container size shall be in accordance with ANLA ANSI/ANLA Z60.1. Plant material shall be grown in a container over a duration of time for new fibrous roots to have developed and for the root mass to retain its shape and hold together when removed from the container. Container-grown plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. The container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

2.1.7 Growth of Trunk and Crown

2.1.7.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANLA ANSI/ANLA Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

- a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
- b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no

division of the trunk which branches more than 6 inches from ground level.

- c. Specimen: The tree provided shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

2.1.7.2 Coniferous Evergreen Plant Material

Coniferous Evergreen plant material shall have the height-to-spread ratio recommended by ANLA ANSI/ANLA Z60.1. The coniferous evergreen trees shall not be "poled" or the leader removed. Acceptable plant material shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

2.1.8 Plant Material Size

Plant material shall be furnished in sizes indicated. Plant material larger in size than specified may be provided at no additional cost to the Government.

2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300 EARTHWORK. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the plant material specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

2.3 SOIL AMENDMENTS

2.3.1 Fertilizer

Fertilizer shall be controlled release commercial grade; free flowing, pellet or tablet form; uniform in composition; and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. Rotted manure is not recommended to be used as a mulch because it would encourage surface rooting of the plant material and weeds.

2.4.1 Organic Mulch

Organic mulch materials shall be native to the project site and consist of recycled mulch, shredded bark, wood chips, or ground bark.

2.4.1.1 Recycled Mulch

Recycled mulch may include compost, tree trimmings, or pine needles with a gradation that passes through a 2-1/2 x 2-1/2 inch screen. It shall be cleaned of all sticks a minimum 1 inch in diameter and plastic materials a minimum 3 inch length. The material shall be treated to retard the growth of mold and fungi. Other recycled mulch may include peanut shells, pecan shells or coco bean shells.

2.4.1.2 Shredded Bark

Locally shredded material shall be treated to retard the growth of mold and fungi.

2.4.1.3 Wood Chips and Ground Bark

Locally chipped or ground material shall be treated to retard the growth of mold and fungi. Gradation: A maximum 2 inch wide by 4 inch long.

2.5 GEOTEXTILE

Geotextile shall be woven or nonwoven; polypropylene, polyester, or fiberglass, mat in accordance with ASTM D 5034 or ASTM D 5035. It shall be made specifically for use as a fabric around plant material. Nominal weight shall be a minimum 4 ounces per square yard. Permeability rate shall be a minimum 0.04 inch per second.

2.6 WOOD STAKING MATERIAL

Wood stakes shall be lodge pole pine; rough sawn; free from knots, rot, cross grain, or other defects that would impair their strength.

2.6.1 Bracing Stake

Wood tree stakes to be lodge pole pine stakes, full length treated with copper naphthanate. Minimum nominal size to be two inches in diameter by eight feet long and pointed at one end. Stakes shall be free from knots, checks, splits, or disfigurements.

2.7 TREE ROOT BARRIERS

Tree root barriers shall be metal or plastic consisting of recycled content. Barriers shall utilize vertical stabilizing members to encourage downward tree root growth. Barriers shall limit, by a minimum 90 percent, the occurrence of surface roots. Tree root barriers which are designed to be used as plant pit liners will be rejected.

PART 3 EXECUTION

3.1 SITE PREPARATION

3.1.1 Finished Grade, Topsoil and Underground Utilities

The Contractor shall verify that finished grades are as indicated on drawings, and that the placing of topsoil, the smooth grading, and the compaction requirements have been completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the planting operation. The location of underground utilities and facilities in the area of the planting operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.1.2 Layout

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted to meet field conditions.

3.1.3 Protecting Existing Vegetation

When there are established lawns in the planting area, the turf shall be covered and/or protected during planting operations. Existing trees, shrubs, and plant beds that are to be preserved shall be barricaded along the dripline to protect them during planting operations.

3.2 EXCAVATION

3.2.1 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments to plant material location, type of plant and planting method shall be submitted for approval.

3.2.2 Turf Removal

Where the planting operation occurs in an existing lawn area, the turf shall be removed from the excavation area to a depth that will ensure the removal of the entire root system.

3.2.3 Plant Pits

Plant pits shall be dug with level bottoms and square sides. Width and depth of pit for plants shall be in accordance with the detail drawings.

3.3 INSTALLATION

3.3.1 Setting Plant Material

Plant material shall be set plumb and held in position until sufficient soil has been firmly placed around root system or ball. In relation to the surrounding grade, the plant material shall be set even with the grade at which it was grown.

3.3.1.1 Bare-Root Plant Material

Bare-root plant material shall be placed in water a minimum 30 minutes

prior to setting.

3.3.2 Tree Root Barrier

Tree root barriers shall be installed as recommended by the manufacturer. Tree root barriers shall be used for trees located up to a maximum 6 feet from paved surfaces or structures.

3.3.3 Backfill Soil Mixture

The backfill soil mixture may be a mix of topsoil and soil amendments suitable for the plant material specified. When practical, the excavated soil from the plant pit that is not amended provides the best backfill and shall be used.

3.3.4 Backfill Procedure

Prior to backfilling, all metal, wood, synthetic products, or treated burlap devices shall be removed from the ball or root system avoiding damage to the root system. The backfill procedure shall remove air pockets from around the root system. Additional requirements are as follows.

3.3.4.1 Balled and Burlapped, and Balled and Platformed Plant Material

Biodegradable burlap and tying material shall be carefully opened and folded back from the top a minimum 1/3 depth from the top of the root ball. Backfill mixture shall be added to the plant pit in 6 inch layers with each layer tamped.

3.3.4.2 Bare-Root Plant Material

The root system shall be spread out and arranged in its natural position. Damaged roots shall be removed with a clean cut. The backfill soil mixture shall be carefully worked in amongst the roots and watered to form a soupy mixture. Air pockets shall be removed from around the root system, and root to soil contact shall be provided.

3.3.4.3 Container-Grown and Balled and Potted Plant Material

The plant material shall be carefully removed from containers that are not biodegradable. Prior to setting the plant in the pit, a maximum 1/4 depth of the root mass, measured from the bottom, shall be spread apart to promote new root growth. For plant material in biodegradable containers the container shall be split prior to setting the plant with container. Backfill mixture shall be added to the plant pit in 6 inch layers with each layer tamped.

3.3.4.4 Earth Berm

An earth berm, consisting of backfill soil mixture, shall be formed with a minimum 3 inch height around the edge of the plant pit to aid in water retention and to provide soil for settling adjustments.

3.3.5 Plant Bed

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas. Earth berms shall be provided.

The planter beds around the patio area should have all soils amended rather than just the soil of the plant pits. Apply evenly: 6-20-20- pre-plant fertilizer at the rate of 20 lbs./1,000 sq. ft., humus (composted, nitrolized bark fines) at 6 c.y./1,000 sq. ft. and soft rock phosphate at 50 lbs/1,000 sq. ft. Incorporate thoroughly into top 6"-8" of planter soil.

3.3.6 Watering

Plant pits and plant beds shall be watered immediately after backfilling, until completely saturated.

3.3.7 Staking and Guying

Staking will be required when trees are unstable or will not remain set due to their size, shape, or exposure to high wind velocity.

3.3.7.1 One Bracing Stake

Trees 4 to 6 feet high shall be firmly anchored in place with one bracing stake. The bracing stake shall be placed on the side of the tree facing the prevailing wind. The bracing stake shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly to the stake with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. A chafing guard shall be used when metal is the guying material.

3.3.7.2 Two Bracing Stakes

Trees from 6 to 8 feet height shall be firmly anchored in place with 2 bracing stakes placed on opposite sides. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly between the stakes with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Chafing guards shall be used when metal is the guying material.

3.4 FINISHING

3.4.1 Plant Material

Prior to placing mulch, the installed area shall be uniformly edged to provide a clear division line between the planted area and the adjacent area, shaped as indicated. The installed area shall be raked and smoothed while maintaining the earth berms.

3.4.2 Placing Geotextile

Prior to placing mulch, geotextile shall be placed as indicated in accordance with the manufacturer's recommendations.

3.4.3 Placing Mulch

The placement of mulch shall occur a maximum 48 hours after planting. Top dress all shrub and ground cover areas with 3 inches of shredded fir bark mulch.

3.4.4 Pruning

Pruning shall be accomplished by trained and experienced personnel. The pruning of trees shall be in accordance with ANSI A300. Only dead or broken material shall be pruned from installed plants. The typical growth habit of individual plant material shall be retained. Cuts shall be made as close to the parent trunk as possible while still leaving the branch collar intact on the trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

3.5 MAINTENANCE DURING PLANTING OPERATION

Installed plant material shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed to prevent desiccation and shall continue until the plant establishment period commences. All trees, shrubs and ground cover areas shall be kept at optimum growing condition by watering, weeding, replanting, fertilizing, cultivating, repairing stakes and ties, restoring water basins, spraying for disease and insects, removing and replacing dead or dying plant material, pruning as directed, maintaining proper grades of plants and providing any other reasonable operations of maintenance and protection required for successful completion of the project. All plantings shall be presented in a 100% weed free condition at the final walk through.

3.6 RESTORATION AND CLEAN UP

3.6.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

3.6.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite. Adjacent paved areas shall be cleared.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02950

IRRIGATION SYSTEM

03/01

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 REQUIREMENTS
- 1.5 SYSTEM PERFORMANCE REQUIREMENTS
 - 1.5.1 Location of Sprinklers and Devices
 - 1.5.2 Minimum Water Coverage
- 1.6 DELIVERY AND STORAGE
- 1.7 JOB SITE CONDITIONS
- 1.8 CODE RULES AND SAFETY ORDERS
- 1.9 SEQUENCING AND SCHEDULING
- 1.10 QUALITY ASSURANCE
 - 1.10.1 Installer Qualifications
 - 1.10.2 Listing/Approval Stamp, Label, or Other Marking
 - 1.10.3 Product Options
- 1.11 AS-BUILT DRAWINGS
- 1.12 GUARANTEE AND REPLACEMENT

PART 2 PRODUCTS

- 2.1 GENERAL MATERIALS
- 2.2 PIPING MATERIALS
 - 2.2.1 Pipe, Fittings and Solvent Cement
 - 2.2.2 Sleeves
 - 2.2.3 Risers
 - 2.2.4 Riser Thread Coating
- 2.3 SPRINKLER HEADS
- 2.4 EMITTER ASSEMBLY
- 2.5 VALVES
 - 2.5.1 Gate Valves
 - 2.5.2 Angle Valves
 - 2.5.3 Quick Coupling Valves
 - 2.5.4 Electrical Remote Control Valves
 - 2.5.5 Backflow Preventers
- 2.6 ACCESSORIES AND APPURTENANCES
 - 2.6.1 Valve Keys
 - 2.6.2 Irrigation Boxes
 - 2.6.3 Concrete Pads
 - 2.6.4 Drainage Backfill for Control Valve Boxes

- 2.7 AUTOMATIC CONTROLLERS
 - 2.7.1 Controllers
 - 2.7.2 Housing
 - 2.7.3 Timing
 - 2.7.4 Chart
 - 2.7.5 Electrical Wiring
- 2.8 WIRING AND RIGID CONDUIT
- 2.9 MISCELLANEOUS ITEMS
 - 2.9.1 Service Clamps
 - 2.9.2 Above Ground Piping
 - 2.9.3 Below Ground Piping

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Sprinkler System
 - 3.1.2 Delivery
 - 3.1.3 Trench
 - 3.1.4 Utility Poles
 - 3.1.5 Piping System - Common Requirements
 - 3.1.6 Piping Installation
 - 3.1.7 Valves
 - 3.1.8 Sprinklers and Valves
 - 3.1.9 Emitter Assembly
 - 3.1.10 Backflow Preventer
 - 3.1.11 Control Wire and Conduit
 - 3.1.12 Automatic Controllers
- 3.2 BACKFILL
- 3.3 ADJUSTMENTS
- 3.4 FLUSHING AND CLEANING
- 3.5 FIELD TESTS
- 3.6 ADJUSTING

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 02950

IRRIGATION SYSTEM

03/01

PART 1 GENERAL

1.1 SUMMARY

This Section describes the labor, materials, and installation of equipment necessary to install an underground irrigation system.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1785	(1991) Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(1989) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1991) Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1990a) Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1987) Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings, Schedule 80
ASTM D 2564	(1991) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1013	(1988) Reduced Pressure Principle Backflow Preventers
-----------	---

FEDERAL SPECIFICATIONS (FS)

FS WW-H-001220	(Basic) Head, Sprinkler, (Underground Connected)
----------------	--

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-80 (1987) Bronze Gate, Globe, Angle and Check
Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (1988) (Rev 1) Industrial Control Devices,
Controllers and Assemblies

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1994) National Electrical Code

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Product Data; FIO.

Submit list of materials proposed for use. Give each item name of manufacturer, brand name and catalog number. Data shall include pressure rating, rated capacity, settings, and electrical information of selected models for the following:

1. Pressure regulators.
2. Valves, including general-duty, underground, manual and automatic control, and quick-coupler types, and valve boxes.
3. Sprinklers, including emitters, drip tubes, and devices.
4. Controls, including controller wiring diagrams.
5. Wiring.

SD-04 Drawings

Wiring Diagrams; FIO.

Wiring diagrams for electrical controllers, valves, and devices.

SD-08 Statements

Warranties and Guarantees; FIO.

Submit all written warranties and guarantees to Contracting Officer. All warranties and guarantees shall be for the manufacturer's specified time.

SD-09 Reports

Performance Test; FIO.

Showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of control valves.

SD-19 Operation and Maintenance Manuals

Manuals; FIO.

Furnish manuals for maintenance and operation of the following:

1. Pressure regulators.
2. Automatic control valves.
3. Sprinklers.
4. Controllers.

Furnish one complete set prior to field testing and the remainder upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule.

1.4 REQUIREMENTS

Furnish and install new automatic irrigation system as shown on the drawings and as specified herein.

Any section of pipe or any component of the irrigation system found to be defective shall be replaced at no additional expense to the government.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

1.5.1 Location of Sprinklers and Devices

Design location is approximate. MINOR adjustments may be made as necessary to avoid plantings and obstructions such as signs, utilities, and light standards. Variation in arrangement of sprinklers and devices from those shown on drawings will be permitted with written approval only. If such variation is made, the contractor shall submit a shop drawing for approval.

1.5.2 Minimum Water Coverage

Not less than:

- A. Turf Areas: 100 percent.
- B. Other Planting Areas: 100 percent.

1.6 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be protected from the weather, excessive humidity and temperature variation, direct sunlight (in the case of plastic or rubber materials), and dirt, dust, or other contaminants.

1.7 JOB SITE CONDITIONS

Verify conditions on site before commencing work. Should utilities be encountered that are not indicated, notify the Contracting Officer immediately. Mark high voltage electrical services with proper warning signs and barricades. Verify all dimensions in the field and advise the Contracting Officer of any discrepancy before performing the work.

Exercise extreme care in excavating near existing structures, trees and utilities to avoid damage. Repair or replace damage caused by this operation at no additional cost to the government.

1.8 CODE RULES AND SAFETY ORDERS

All work installed or material used must comply with the latest rules and regulations of National Electrical Code, Uniform Plumbing Code and Associated IAMPO Installation Standards.

1.9 SEQUENCING AND SCHEDULING

Maintain uninterrupted water service to building during normal working hours. Arrange for temporary water shutoff with the Government.

If water service for irrigation to existing landscaping is interrupted during construction, Contractor shall provide temporary irrigation system, as necessary, to maintain all affected plantings in healthy condition.

1.10 QUALITY ASSURANCE

1.10.1 Installer Qualifications

Experienced installer who has completed irrigation systems similar in material, design, and extent to that indicated for project that have resulted in construction with a record of successful in-service performance.

1.10.2 Listing/Approval Stamp, Label, or Other Marking

On equipment, specialties, and accessories made to specified standards.

1.10.3 Product Options

Irrigation system piping, specialties, and accessories are based on specific types, manufacturers, and models indicated. Components with equal performance characteristics produced by other manufacturers may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as judged by the Contracting Officer. The burden of proof of product equality is on the Contractor.

1.11 AS-BUILT DRAWINGS

Keep graphic record of field revisions to design layout. Contractor shall furnish final as-built drawings as indicated in Section 01300.

1.12 GUARANTEE AND REPLACEMENT

All components of the irrigation system shall be guaranteed against defects for a period of one (1) year, following Contracting Officer acceptance of the project. Replacement of defective components shall be made in the same manner as specified for the original plan at no extra cost to the government.

PART 2 PRODUCTS

2.1 GENERAL MATERIALS

A. Each item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

B. The following extra stock shall be provided: Two sprinkler heads of each size and type, two valve keys for operating manual valves, two wrenches for removing and installing each type of head, two quick coupler keys and hose swivels, and four irrigation controller housing keys.

2.2 PIPING MATERIALS

2.2.1 Pipe, Fittings and Solvent Cement

A. Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 40 and 80.

B. Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40. Threaded type fittings shall conform to requirements of ASTM D 2464, Schedule 80.

C. Solvent cement shall conform to the requirements of ASTM D 2564.

2.2.2 Sleeves

Sleeves under walkway paving shall be schedule 40, polyvinyl chloride 1120 normal impact pipe conforming to ASTM D1785.

2.2.3 Risers

Plastic pipe for risers shall be Schedule 80 and shall conform to ASTM D 2241 and shall meet the requirements for portable water.

2.2.4 Riser Thread Coating

For plastic pipe use MIL-T-27730A-1964, Tape, antiseize, Polytetrafluorethylene with dispenser (PFE TAPE) or as per manufacturer's recommendations.

2.3 SPRINKLER HEADS

A. Pop-Up Spray Heads shall conform to the requirements of FS WW-H-001220, Type II, Class A. Nozzle shall rise a minimum of 4 inches above body in lawns and 6 inches or 12 inches in groundcover and shrub areas. Sprinkler heads shall be conical spray with adjustable or non-adjustable coverage and designed for permanent above ground mounting on riser. All heads shall have built-in check valves. Spray heads and interchangeable nozzles to be Rainbird 1800 Series or approved equal.

B. Bubbler Heads shall be stream, umbrella or trickle bubbler with pressure compensation and designed for permanent above ground mounting on risers or, using an adapter, on pop-up bodies as specified above. Bubblers to be pressure compensating bubblers. Bubblers to be by Rainbird Sprinkler Corp., or approved equal.

2.4 EMITTER ASSEMBLY

A. The emitters shall be of pressure compensating a continuous flushing type known as a Groove and Flap Short Path Emitter. The case of the emitter shall be made of durable black, plastic material. It shall be resistant to temperature variation, ultraviolet radiation, smog (ozone), common liquid fertilizer and weed spray. The case shall completely encompass the diaphragm, protecting it from potentially harmful environmental factors.

B. The emitter shall be capable of continuous, self-flushing, clog-free operation with 200 mesh (minimum) filtration for 1/2 GPH and 150 mesh for 1 and 2 GPH emitter. The emitter shall be capable of being installed in any position and maintain its given flow characteristics. The emitter shall be non-adjustable and the flow regime shall be maintained by a flexible silicon rubber diaphragm.

C. The emitter shall function with a system pressure range of 5 psi minimum to 50 psi maximum.

D. The 2 GPH emitter shall be capable of delivering 2.05 gph at 20 psi, 1.75 gph at 50 psi.

E. The 1 GPH emitter shall be capable of delivering 1 gph at 20 psi, 1 gph at 50 psi.

F. The 1/2 GPH emitter shall be capable of delivering .5 gph at 20 psi, .45 gph at 50 psi.

G. The emitter distribution tubing between the emitter and the .580 inch OD emitter hose shall be .187-inch ID, .250-inch OD. The tubing between the emitter outlet and the point of discharge shall be vinylized .150-inch ID, .220- inch OD. All tubing shall fit tightly with the corresponding emitter barbs, adapters and discharge outlet openings.

2.5 VALVES

2.5.1 Gate Valves

Gate Valves, less than 3 Inches shall conform to the requirements of MSS SP-80, Type 1, solid wedge; nonrising, copper-silicon-alloy stem; Class 125, body and screw bonnet of ASTM B 62 cast bronze, with threaded or solder-joint ends. Include polytetrafluoroethylene (PTFE)-impregnated packing, brass packing gland, and malleable-iron handwheel.

2.5.2 Angle Valves

Angle Valves, less than 2-1/2 Inches shall conform to the requirements of MSS SP-80, Type 3, Class 150 with threaded or soldered ends.

2.5.3 Quick Coupling Valves

Quick Coupling Valves shall have brass parts and shall be two-piece unit consisting of a coupler water seal valve assembly and a removable upper body to allow spring and key track to be serviced without shutdown of main.

Lids shall be lockable vinyl with spring for positive closure on key removal.

2.5.4 Electrical Remote Control Valves

Electrical Remote Control Valves shall be solenoid actuated globe valves with self-cleaning nylon scrubber and stainless steel screen, of 1- to 3-inch size, suitable for 24 volts, 50/60 cycle, and designed to provide for shut-off in event of power failure. Construction shall be glass-filled nylon housing suitable for service at 200 psi operating pressure with external flow control adjustment for shut-off capability, external plug at diaphragm chamber to enable manual operation, filter in control chamber to prevent valve body clogging with debris, durable diaphragm, and accessibility to internal parts without removing valve from system.

R.C.V.'s to be Rainbird PEB series, or approved equal.

2.5.5 Backflow Preventers

A. Reduced pressure principle backflow preventers shall be in accordance with ASSE 1013.

B. Backflow prevention unit(s) of the type(s) indicated shall be installed above ground at the location(s) shown on the drawings. Where union connections are not provided as part of the unit, the Contractor shall provide and install a union or sleeve type coupling between the control valve and the inlet side of the unit. Pipe and fittings for backflow prevention units shall be copper. A minimum of five (5) feet of copper pipe shall be used on each side of this equipment from source as well as to valve assembly.

C. Reduced Pressure Type Backflow Preventers shall be Class 150 flanged bronze mounted gate valve and strainer, stainless steel or bronze, internal parts. Total pressure drop through complete assembly shall be a maximum of 10 psi at rated flow. Piping shall be red brass pipe and fittings or galvanized steel pipe and fittings. Strainers shall be bronze or brass construction with gasket caps. Units shall have 200-mesh stainless steel

screen elements.

2.6 ACCESSORIES AND APPURTENANCES

2.6.1 Valve Keys

Valve keys shall be 1/2-inch diameter by 3 feet long, tee handles and keyed to fit valves.

2.6.2 Irrigation Boxes

Irrigation boxes shall be Polyethylene (PE), acrylonitrile-butadiene-styrene (ABS), fiberglass or polymer concrete and cover. Size as required for application. The words "gate valve", for gate valves; and "RCA" for remote control valves shall be cast in covers of boxes for the irrigation system. The boxes shall be such length as will be adapted, without full extension, to the depth of cover required over the pipe at valve location. Plastic boxes shall be a standard catalog product of a manufacturer regularly engaged in the manufacture of valve boxes. Plastic boxes installed in turfed areas shall have green covers. Boxes housing control valves shall have lockable covers.

2.6.3 Concrete Pads

Concrete pads shall be precast or cast-in-place reinforced concrete construction for reduced pressure type backflow preventers.

2.6.4 Drainage Backfill for Control Valve Boxes

Drainage Backfill For Control Valve Boxes: Cleaned gravel or crushed stone, graded from 2 inches maximum to 3/4 inch minimum.

2.7 AUTOMATIC CONTROLLERS

2.7.1 Controllers

Controllers shall be the product of a manufacturer regularly engaged in the production of irrigation controllers and sprinkler systems and shall be specifically designed for use on landscaping. Controller shall be capable of complete automatic and manual operation of all connected stations. Each controller shall have a master switch to disconnect controller from supply lines. Controllers to be by Irritrol Systems or Rainbird Sprinkler Mfg. Corp., or approved equal. Model(s) to be as indicated on the drawings.

2.7.2 Housing

Controller shall be enclosed in a tamperproof, weatherproof and lockable housing.

2.7.3 Timing

Timing for each station shall be variable up to 99 minutes. The programming cycle shall be not less than 14 calendar days. Each station shall be independently timed, scheduled, or omitted. Programming shall be

changeable without special tools and without disassembling controller.

2.7.4 Chart

A chart, encased in plastic, showing clearly the areas serviced by each remote control valve shall be provided at each controller.

2.7.5 Electrical Wiring

Electrical wiring from controller to control valves shall be UL 493, solid, single conductor, copper wire, type RHW OR XHHWUF, rated for direct burial, with minimum wire size No. 14 AWG and No. 12 AWG to be used on runs of 2000 ft. or more. Common wire shall be a different color from all others. Regardless of the number or location of valves connected to a single controller station, separate control wires shall be run from the controller station to each valve. Wiring from controllers to source shall be installed in EMT steel, one-half (1/2) inch conduit minimum.

A. A master on/off button shall provide for system shut-down while maintaining programming. Electrical surge protection, lightning protection and battery back-up shall be an integral part of the controller and shall be provided on both the primary and circuit lines.

B. All programming shall be accomplished via keyboard entry with all readouts LED displayed.

C. Wire connections to remote control valves and at wire splices shall be made with UL approved, sealant (cycohexanone) filled, water-tight wire connectors installed as recommended by the manufacturer.

2.8 WIRING AND RIGID CONDUIT

Wiring and rigid conduit for electrical power shall be in accordance with NFPA 70.ND.

2.9 MISCELLANEOUS ITEMS

2.9.1 Service Clamps

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable iron body with cadmium plated straps and nuts. Clamps shall have rubber gasket cemented to the body.

2.9.2 Above Ground Piping

Above ground piping shall be copper.

2.9.3 Below Ground Piping

Pipe smaller than four (4) inches shall be plastic as specified on drawings. Pipe for sleeving shall be Schedule 40 or 80 PVC, as specified on drawings. PVC piping shall have metal locator tape marked.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Sprinkler System

Sprinkler system shall be installed after site grading has been completed. Excavation, trenching, and backfilling for sprinkler system shall be in accordance with the applicable provisions of Section 02300, Earthwork, except as modified herein.

3.1.2 Delivery

Pipes shall be delivered to site in unbroken bundles or rolls packaged in such a manner as to provide adequate protection for pipe ends, threaded or plain.

3.1.3 Trench

Trench around roots shall be hand excavated to pipe grade when roots of (two) 2 inches diameter or greater are encountered. Trench width shall be (four) 4 inches minimum or 1-1/2 times diameter of pipe, whichever is wider. Backfill shall be hand tamped over excavation. When rock is encountered, trench shall be excavated (four) 4 inches deeper and backfilled with silty sand (SM) or well-graded sand (SW) to pipe grade. Trenches shall be kept free of obstructions and debris that would damage pipe. Subsoil shall not be mixed with topsoil. Existing concrete walks, drives and other obstacles shall be bored at a depth conforming to bottom of adjacent trenches. Pipe sleeves for bored pipe shall be two pipe diameters larger than sprinkler pipe.

3.1.4 Utility Poles

Where necessary to excavate near utility poles, exercise care to avoid damage to pole and route underground piping a minimum of 2 feet from the base of the pole for 12-inch deep trenches and a minimum of 3 feet from the base of pole for 18-inch - 24-inch deep trenches.

3.1.5 Piping System - Common Requirements

A. The minimum backfill cover over pipe and wiring, except where shown otherwise on the drawings, shall be as follows:

1. Main Lines, Pressurized Pipe - 18 inches
2. 24 Volt Wiring - 18 inches, except where in sleeve under roadway
3. Lateral Lines, Non-Pressurized Pipe - 12 inches
4. Pipe Sleeves - 24 inches, as shown on detail drawings

B. Minimum horizontal clearances between lines shall be 4 inches for pipe 2 inches and less; 12 inches for 2-1/2 inches and larger. Minimum vertical clearances between lines shall be 1 inch.

C. Pipe shall be installed in a serpentine (snaked) manner to allow for

expansion and contraction in trench before backfilling. Pipes shall be installed at temperatures over 5 degrees C. (40 degrees F.). Allow joints to cure at least 24 hours at temperature above 40 deg F before testing, unless otherwise recommended by manufacturer.

3.1.6 Piping Installation

- A. Install underground polyvinyl chloride (PVC) plastic pipe according to ASTM D 2774.
- B. Solvent-cemented joints shall conform to the requirements of ASTM D 2855.
- C. Threaded joints shall be full cut with a maximum of three threads remaining exposed on pipe and nipples. Threaded joints shall be made tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.
- D. Piping shall be joined to conform with requirements of ASTM D 2774 or ASTM D 2855, and pipe manufacturer's instructions.
- E. Pipe shall be reamed and burrs removed. Contact surfaces of joint shall be cleaned and polished. Flux shall be applied to male and female ends. End of tube shall be inserted into fittings full depth of socket. After soldering, a solder bead shall show continuously around entire joint circumference. Excess acid flux shall be removed from tubings and fittings.
- F. Threads shall be cut in conformance with ASME B1.2. Pipe joint compound shall be applied to male end only.
- G. Piping under concrete may be installed by jacking, or hydraulic driving.
- H. Handling. Pipe and accessories shall be handled so as to ensure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. If the coating or lining of any pipe or fitting is damaged, the repair or replacement shall be made by the contractor at his expense in a satisfactory manner. Before installation the pipe shall be inspected for defects. Material found to be defective before or after placement shall be replaced with sound material without additional expense to the government.
- I. Install piping under sidewalks and paving in sleeves.

3.1.7 Valves

- A. Manual Valves shall be installed in a valve box extending from grade to below valve body, with a minimum of 4-inches cover measured from finish grade to top of valve stem.
- B. Automatic Valves shall be set plumb in a valve box extending from grade to below valve body, with minimum of 4-inch cover measured from grade to top of valve. Locate and arrange valves for easy adjustment and removal. Install union on downstream side.

C. Install valve box at each valve location with cover. Set top of box 1 inch above finish grade in lawn areas and 2 inches above finish grade in shrub beds. Place drain rock under all valves to a six inch depth with a three (3) inch clearance under each valve.

D. Entire system shall be manually or automatically drainable. Low points of system shall be equipped with drain valve draining into an excavation containing 1 cubic foot cleaned gravel or crushed stone, graded from 3 inches to 3/4 inch minimum. Cover drain material with sheet of ASTM D 226, Type II, asphalt-saturated felt and backfill remainder with excavated material and 6 inches of topsoil.

3.1.8 Sprinklers and Valves

Sprinklers and valves shall be installed plumb and level with terrain.

3.1.9 Emitter Assembly

A. The maximum length of the distribution tubing shall be as detailed on the project drawings. In the event the distance in the field exceeds the maximum length, the Contractor shall extend the .600 OD emitter hose as required by adding a tee and shall add a flush valve at the end of each extension. This work, if necessary, shall be performed at Contractor's expense and the emitter and distribution tubing shall be assembled using the manufacturer's recommended tools and accessories.

B. The emitter assembly shall consist of the emitter unit, flexible polyethylene emitter distribution tubings (length as required) and molded polyethylene adapter.

3.1.10 Backflow Preventer

A. Backflow Preventer shall be installed on the concrete pad between connection and control valves.

B. Reduced Pressure Type shall be installed as follows: Flush pipe lines prior to installing device and protect device by a strainer located upstream. Device shall not be installed in pits or where any part of device could become submerged in standing water. Install according to the details on the drawings and in accordance with the manufacturer's recommendations.

3.1.11 Control Wire and Conduit

A. Low voltage wires may be buried beside pipe in same trench. Rigid conduit shall be provided where wires run under paving. Wires shall be number tagged at key locations along main to facilitate service. One control circuit shall be provided for each zone and a circuit to control sprinkler system.

B. A 24-inch loop of wire shall be provided at each valve where controls are connected.

C. Multiple tubes or wires shall be bundled and taped together at 10 foot intervals with 12-inch loop for expansion and contraction.

D. Electrical splices shall be waterproof. Wire connections to remote control valves and at wire splices shall be made with UL approved, sealant (cycohexanone) filled, water-tight wire connectors installed as recommended by the manufacturer.

3.1.12 Automatic Controllers

Exact field location of Automatic Controllers shall be determined before installation. Coordinate the electrical service to these locations. Install in accordance with manufacturer's recommendations and NFPA 70.

3.2 BACKFILL

A. Top 3 inches of trench backfill shall be filled with topsoil. Compact soil in trenches with plate hand-held compactors to same density as undisturbed adjacent soil. Any settling of trenches within 90 days of project completion shall be corrected by the contractor at no additional cost to the government.

B. Complete backfilling only after piping has been inspected, flushed, and pressure tested. Backfill to be free from rocks, concrete chunks, and foreign material.

C. Plastic pipe laid in or across roadways or other locations which will be subject to vehicular traffic shall be placed in sleeves capable of withstanding the anticipated static and moving loads. Sleeves shall extend at least 18 inches beyond the edges of the pavement.

3.3 ADJUSTMENTS

After grading, seeding, and rolling of planted areas, sprinkler heads shall be adjusted flush with finished grade. Adjustments shall be made by providing new nipples of proper length or by use of heads having an approved device, integral with head, or by the use of swing joint assemblies, which will permit adjustment in height of head without changing piping.

3.4 FLUSHING AND CLEANING

Prior to the hydrostatic and operation tests, the interior of the pipe shall be flushed with clean water until pipe is free of all foreign materials. Flushing and cleaning out of system pipe, valves, and components shall not be considered completed until witnessed and accepted by Contracting Officer.

3.5 FIELD TESTS

A. All instruments, equipment, facilities, and labor required to conduct the tests shall be provided by Contractor.

B. Piping shall be tested hydrostatically before backfilling and proved

tight at a hydrostatic pressure of 150 psi without pumping for a period of one hour with an allowable pressure drop of 5 psi. If hydrostatic pressure cannot be held for a minimum of 4 hours, Contractor shall make adjustments or replacements and the tests repeated until satisfactory results are achieved and accepted by the Contracting Officer.

C. If solvent welded joints are used for plastic pipe, the line shall not be subjected to pressure testing for at least 24 hours following the completion of the line to be tested.

D. At conclusion of pressure test, sprinkler heads or emitter heads and quick coupling assemblies shall be installed and entire system tested for operation under normal operating pressure. Operation test consists of the system operating through at least one complete programmed cycle for all areas to be sprinkled.

3.6 ADJUSTING

A. Adjust all emitters, sprinklers, and bubblers, for proper pattern, water flow, and distance. Adjust any pressure regulators to specified pressures or as directed in the field.

B. At the initial installation, the pressure reducing valve shall be field adjusted to the manufacturer's recommended psi.

C. Automatic Controller System. Automatic controller system shall be installed at the location shown on the drawings, unless otherwise directed. Installation shall include connection to power supply of 105 to 125 volts and power step-down transformer connections to the individual valve solenoids as required for the automatic controller system. All electrical material provided and installed shall meet the latest issue of the electrical code for the area and all electric wire shall be U/L approved. The controller unit shall be provided with waterproof and dustproof cover. After completion of the installation, the system shall be adjusted and field tested to assure compliance with the manufacturer's capabilities and operational control of each zone or station to satisfy the design requirements. All tests and operational compliance shall be subject to the acceptance and approval by the Contracting Officer.

D. Connect remote control valves on system to controller in sequence to correspond with station setting beginning with station 1, 2, 3, etc.

E. Test controller for minimum of 10 days before end of establishment period. System shall operate automatically in manner specified. Set controller for night watering, between 11:00 pm and 8:00 am, or as directed.

F. Instruct government maintenance personnel by a qualified person of the manufacturer's representative on use and adjustment of automatic sprinkler controller during this 10 day test period.

G. Contractor shall adjust heads in turf areas flush with settled, finished grade prior to final completion of planting operations as directed by the Contracting Officer. Sprinkler heads and valves shall be installed in accordance with the recommendations of the manufacturer. Uniform and

complete coverage of the areas to be irrigated shall be obtained. All sprinkler heads of the same type and capacity on a single control valve shall be adjusted to provide coverage consistent with each other and to minimize overspray onto adjacent paving or buildings.

H. The Contractor shall assume full responsibility for the correct installation of the emitter system, as herein specified and unless he can show past experience of installing this type of system, he shall arrange with the manufacturer for the services of a qualified manufacturer's representative to be on hand at the start of the installation and as necessary during the installation and testing of the system. All emitter hose shall be flushed prior to and after installation of emitter assemblies. Attach manual self-closing flush valve at the end of each line.

I. A field training course shall be provided for designated operating and maintenance staff members. Training shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals. Provide 7 days written notice in advance of training.

J. Develop watering schedule to provide watering for planting during 90-day establishment period and for lawn during 90-day establishment period. Submit watering schedule to the Contracting Officer for approval. The sprinkler system shall be maintained by the contractor during establishment period.

K. After completion of all work, set automatic sprinkler controller to operate on schedule commensurate with good water practices according to local weather and soil conditions. Submit watering schedule with recommended seasonal variations in the schedule to the Contracting Officer for approval.

L. Upon completion of installation of system, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 03 - CONCRETE

SECTION 03100

STRUCTURAL CONCRETE FORMWORK

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DESIGN
- 1.3 STORAGE AND HANDLING

PART 2 PRODUCTS

- 2.1 FORM MATERIALS
 - 2.1.1 Forms For Class A and Class B Finish
 - 2.1.2 Forms For Class C Finish
 - 2.1.3 Forms For Class D Finish
 - 2.1.4 Form Ties
 - 2.1.5 Form Releasing Agents
 - 2.1.6 Fiber Voids

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Formwork
 - 3.1.2 Fiber Voids
- 3.2 CHAMFERING
- 3.3 COATING
- 3.4 REMOVAL OF FORMS

-- End of Section Table of Contents --

SECTION 03100

STRUCTURAL CONCRETE FORMWORK
03/01

Includes Special Change (Submittal Paragraph)(June 2000)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 347R (1994) Guide to Formwork for Concrete

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA ANSI/AHA A135.4 (1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 578 (1995) Rigid, Cellular Polystyrene Thermal Insulation

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1996) Voluntary Product Standard - Construction and Industrial Plywood

1.2 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

1.3 STORAGE AND HANDLING

Fiber voids shall be stored above ground level in a dry location. Fiber voids shall be kept dry until installed and overlaid with concrete.

PART 2 PRODUCTS

2.1 FORM MATERIALS

2.1.1 Forms For Class A and Class B Finish

Forms for Class A and Class B finished surfaces shall be plywood panels conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels.

2.1.2 Forms For Class C Finish

Forms for Class C finished surfaces shall be shiplap lumber; plywood conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II; tempered concrete form hardboard conforming to AHA ANSI/AHA A135.4; other approved concrete form material; or steel, except that steel lining on wood sheathing shall not be used.

2.1.3 Forms For Class D Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

2.1.4 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spill concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 1/4 inch nor more than 1 inch deep and not more than 1 inch in diameter. Removable tie rods shall be not more than 1-1/2 inches in diameter.

2.1.5 Form Releasing Agents

Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

2.1.6 Fiber Voids

Fiber voids shall be the product of a reputable manufacturer regularly engaged in the commercial production of fiber voids. The voids shall be constructed of double faced, corrugated fiberboard. The corrugated fiberboard shall be fabricated of standard kraft paper liners, impregnated with paraffin, and laminated with moisture resistant adhesive, and shall have a board strength of 275 psi. Voids which are impregnated with paraffin after construction, in lieu of being constructed with paraffin impregnated fiberboard, are acceptable. Voids shall be designed to support not less than 1000 psf. To prevent separation during concrete placement fiber voids shall be assembled with steel or plastic banding at 4 feet on

center maximum, or by adequate stapling or gluing as recommended by the manufacturer. Fiber voids placed under concrete slabs and that are 8 inches in depth may be heavy duty "waffle box" type, constructed of paraffin impregnated corrugated fiberboard.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Formwork

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class A or Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive units, the forms shall fit over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

3.1.2 Fiber Voids

Voids shall be placed on a smooth firm dry bed of suitable material, to avoid being displaced vertically, and shall be set tight, with no buckled cartons, in order that horizontal displacement cannot take place. Each section of void shall have its ends sealed by dipping in paraffin, with any additional cutting of voids at the jobsite to be field dipped in the same type of sealer, unless liners and flutes are completely impregnated with paraffin. Prior to placing reinforcement, the entire formed area for slabs shall be covered with a 4 x 8 feet minimum flat sheets of fiber void corrugated fiberboard. Joints shall be sealed with a moisture resistant tape having a minimum width of 3 inches. If voids are destroyed or damaged and are not capable of supporting the design load, they shall be replaced prior to placing of concrete.

3.2 CHAMFERING

Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

3.3 COATING

Forms for Class A and Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C and D finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures, coating shall be mandatory. Surplus coating on form surfaces and coating

on reinforcing steel and construction joints shall be removed before placing concrete.

3.4 REMOVAL OF FORMS

Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads. Supporting forms or shores shall not be removed before the concrete strength has reached 70 percent of design strength, as determined by field cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens, and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

TABLE 1

TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:	In any 10 feet of length ----- 1/4 inch
a. In the lines and surfaces of columns, piers, walls and in arises	Maximum for entire length ----- 1 inch
b. For exposed corner columns, control-joint grooves, and other conspicuous lines	In any 20 feet of length ----- 1/4 inch Maximum for entire length ----- 1/2 inch
2. Variation from the level or from the grades indicated on the drawings:	In any 10 feet of length ----- 1/4 inch In any bay or in any 20 feet of length ----- 3/8 inch
a. In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores	Maximum for entire length ----- 3/4 inch
b. In exposed lintels,	In any bay or in any 20 feet of

TABLE 1

TOLERANCES FOR FORMED SURFACES

sills, parapets, horizontal grooves, and other conspicuous lines	length ----- 1/4 inch Maximum for entire length----- 1/2 inch
3. Variation of the linear building lines from established position in plan	In any 20 feet ----- 1/2 inch Maximum -----1 inch
4. Variation of distance between walls, columns, partitions	1/4 inch per 10 feet of distance, but not more than 1/2 inch in any one bay, and not more than 1 inch total variation
5. Variation in the sizes and locations of sleeves, floor openings, and wall opening	Minus ----- 1/4 inch Plus ----- 1/2 inch
6. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls	Minus ----- 1/4 inch Plus ----- 1/2 inch
7. Footings:	
a. Variation of dimensions in plan	Minus ----- 1/2 inch Plus ----- 2 inches when formed or plus 3 inches when placed against unformed excavation
b. Misplacement of eccentricity	2 percent of the footing width in the direction of misplacement but not more than 2 inches
c. Reduction in thickness of specified thickness	Minus ----- 5 percent
8. Variation in steps:	Riser ----- 1/8 inch
a. In a flight of stairs	Tread ----- 1/4 inch
b. In consecutive steps	Riser ----- 1/16 inch Tread ----- 1/8 inch

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 03 - CONCRETE

SECTION 03150

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 CONTRACTION JOINT STRIPS
- 2.2 PREFORMED EXPANSION JOINT FILLER
- 2.3 SEALANT
 - 2.3.1 Preformed Polychloroprene Elastomeric Type
 - 2.3.2 Lubricant for Preformed Compression Seals
 - 2.3.3 Hot-Poured Type
 - 2.3.4 Field Molded Type
- 2.4 WATERSTOPS
 - 2.4.1 Non-Metallic Materials
 - 2.4.2 Preformed Elastic Adhesive
 - 2.4.2.1 Chemical Composition
 - 2.4.2.2 Adhesion Under Hydrostatic Pressure
 - 2.4.2.3 Sag of Flow Resistance
 - 2.4.2.4 Chemical Resistance

PART 3 EXECUTION

- 3.1 JOINTS
 - 3.1.1 Contraction Joints
 - 3.1.1.1 Joint Strips
 - 3.1.1.2 Sawed Joints
 - 3.1.2 Joint Sealant
 - 3.1.2.1 Joints With Preformed Compression Seals
 - 3.1.2.2 Joints With Field-Molded Sealant
- 3.2 WATERSTOPS, INSTALLATION AND SPLICES
 - 3.2.1 Non-Metallic
 - 3.2.1.1 Rubber Waterstop
 - 3.2.1.2 Polyvinyl Chloride Waterstop
 - 3.2.1.3 Quality Assurance
 - 3.2.2 Non-Metallic Hydrophilic Waterstop Installation
 - 3.2.3 Preformed Plastic Adhesive Installation
- 3.3 CONSTRUCTION JOINTS

-- End of Section Table of Contents --

SECTION 03150

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 111 (1983) Inorganic Matter or Ash in
Bituminous Materials

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA ANSI/AHA A135.4 (1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 109 (1993) Steel, Strip, Carbon, Cold-Rolled

ASTM A 109M (1991) Steel, Strip, Carbon, Cold-Rolled
(Metric)

ASTM A 167 (1996) Stainless and Heat-Resisting
Chromium-Nickel Steel Plate, Sheet, and
Strip

ASTM A 480/A 480M (1996a) General Requirements for
Flat-Rolled Stainless and Heat-Resisting
Steel Plate, Sheet, and Strip

ASTM A 570/A 570M (1996) Steel, Sheet and Strip, Carbon,
Hot-Rolled, Structural Quality

ASTM B 152 (1994) Copper Sheet, Strip, Plate, and
Rolled Bar

ASTM B 152M (1995) Copper Sheet, Strip, Plate, and
Rolled Bar (Metric)

ASTM B 370 (1992) Copper Sheet and Strip for Building

Construction

ASTM C 919	(1984; R 1992) Use of Sealants in Acoustical Applications
ASTM C 920	(1995) Elastomeric Joint Sealants
ASTM D 4	(1986; R 1993) Bitumen Content
ASTM D 6	(1995) Loss on Heating of Oil and Asphaltic Compounds
ASTM D 412	(1997) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 471	(1996) Rubber Property - Effect of Liquids
ASTM D 1190	(1996) Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 1191	(1984; R 1994) Test Methods for Concrete Joint Sealers
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1854	(1996) Specification for Jet-Fuel-Resistant Concrete Joint Sealer, Hot-Poured Elastic Type
ASTM D 1855	(1989) Test Method for Jet-Fuel Resistant Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 2628	(1991) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D 2835	(1989; R 1993) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
ASTM D 5249	(1995) Backer Material for Use With Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

CORPS OF ENGINEERS (COE)

COE CRD-C 513 (1974) Corps of Engineers Specifications
for Rubber Waterstops

COE CRD-C 572 (1974) Corps of Engineers Specifications
for Polyvinylchloride Waterstop

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Waterstops; FIO.

Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); preformed compression seals; and waterstops.

SD-13 Certificates

Preformed Expansion Joint Filler; FIO. Sealant; FIO. Waterstops; FIO.

Certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified.

1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA ANSI/AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

2.3 SEALANT

Joint sealant shall conform to the following:

2.3.1 Preformed Polychloroprene Elastomeric Type

ASTM D 2628.

2.3.2 Lubricant for Preformed Compression Seals

ASTM D 2835.

2.3.3 Hot-Poured Type

ASTM D 1190 tested in accordance with ASTM D 1191.

2.3.4 Field Molded Type

ASTM C 920, Type M for horizontal joints or Type NS for vertical joints, Class 25, and Use NT. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

2.4 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated.

2.4.1 Non-Metallic Materials`

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

2.4.2 Preformed Elastic Adhesive

2.4.2.1 Chemical Composition

The chemical composition of the sealing compound shall meet the requirements shown below:

PERCENT BY WEIGHT

COMPONENT	MIN.	MAX.	TEST
Bitumen (Hydrocarbon plastic)	50	70	ASTM D 4
Inert Mineral Filler	30	50	AASHTO T 111
Volatile Matter		2	ASTM D 6

2.4.2.2 Adhesion Under Hydrostatic Pressure

The sealing compound shall not leak at the joints for a period of 24 hours under a vertical 6 foot head pressure. In a separate test, the sealing compound shall not leak under a horizontal pressure of 10 psi which is reached by slowly applying increments of 2 psi every minute.

2.4.2.3 Sag of Flow Resistance

Sagging shall not be detected when tested as follows: Fill a wooden form 1 inch wide and 6 inches long flush with sealing compound and place in an oven at 135 degrees F in a vertical position for 5 days.

2.4.2.4 Chemical Resistance

The sealing compound when immersed separately in a 5% solution of caustic potash, a 5% solution of hydrochloric acid, 5% solution of sulfuric acid and a saturated hydrogen sulfide solution for 30 days at ambient room temperature shall show no visible deterioration.

PART 3 EXECUTION

3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

3.1.1 Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 1/8 inch wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

3.1.1.1 Joint Strips

Strips shall be of the required dimensions and as long as practicable. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. True alignment of the strips shall be maintained during insertion.

3.1.1.2 Sawed Joints

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power,

and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

3.1.2 Joint Sealant

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

3.1.2.1 Joints With Preformed Compression Seals

Compression seals shall be installed with equipment capable of installing joint seals to the prescribed depth without cutting, nicking, twisting, or otherwise distorting or damaging the seal or concrete and with no more than 5 percent stretching of the seal. The sides of the joint and, if necessary, the sides of the compression seal shall be covered with a coating of lubricant. Butt joints shall be coated with liberal applications of lubricant.

3.1.2.2 Joints With Field-Molded Sealant

Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 40 degrees F. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed.

Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

3.2 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

3.2.1 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be

maintained across the splice.

3.2.1.1 Rubber Waterstop

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.

3.2.1.2 Polyvinyl Chloride Waterstop

Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3.2.1.3 Quality Assurance

Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

3.2.2 Non-Metallic Hydrophilic Waterstop Installation

Ends to be joined shall be miter cut with sharp knife or shears. The ends shall be adhered with cyanacrylate (super glue) adhesive. When joining hydrophilic type waterstop to PVC waterstop, the hydrophilic waterstop shall be positioned as shown on the drawings. A liberal amount of a single component hydrophilic sealant shall be applied to the junction to complete the transition.

3.2.3 Preformed Plastic Adhesive Installation

The installation of preformed plastic adhesive waterstops shall be a prime, peel, place and pour procedure. Joint surfaces shall be clean and dry before priming and just prior to placing the sealing strips. The end of each strip shall be spliced to the next strip with a 1 inch overlap; the overlap shall be pressed firmly to release trapped air. During damp or cold conditions the joint surface shall be flashed with a safe, direct flame to warm and dry the surface adequately; the sealing strips shall be dipped in warm water to soften the material to achieve maximum bond to the concrete surface.

3.3 CONSTRUCTION JOINTS

Construction joints are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 03 - CONCRETE

SECTION 03200

CONCRETE REINFORCEMENT

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 WELDING
- 1.3 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 DOWELS
- 2.2 REINFORCING STEEL
- 2.3 WIRE TIES
- 2.4 SUPPORTS

PART 3 EXECUTION

- 3.1 REINFORCEMENT
 - 3.1.1 Placement
 - 3.1.2 Splicing
- 3.2 DOWEL INSTALLATION

-- End of Section Table of Contents --

SECTION 03200

CONCRETE REINFORCEMENT

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318/318R	(1995) Building Code Requirements for Structural Concrete and Commentary
ACI 318M	(1995) Building Code Requirements for Structural Concrete and Commentary (Metric)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1999) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 82	(1997a) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 184/A 184M	(1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 615/A 615M	(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 675/A 675M	(1990a; R 1995e1) Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A 706/A 706M	(1998) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 767/A 767M	(1997) Zinc-Coated (Galvanized) Steel Bars in Concrete Reinforcement
ASTM A 775/A 775M	(1997e1) Epoxy-Coated Reinforcement Steel Bars
ASTM C 1116	(1995) Fiber-Reinforced Concrete and

Shotcrete

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4 (1998) Structural Welding Code -
Reinforcing Steel

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI MSP-1 (1996) Manual of Standard Practice

1.2 WELDING

Welders shall be qualified in accordance with AWS D1.4. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4.

1.3 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 DOWELS

Dowels shall conform to ASTM A 675/A 675M, Grade 80. Steel pipe conforming to ASTM A 53, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

2.2 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82. In highly corrosive environments or when directed by the Contracting Officer, reinforcing steel shall conform to ASTM A 767/A 767M or ASTM A 775/A 775M as appropriate.

2.3 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.4 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless

steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318/318R. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318/318R at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318/318R. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318/318R and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal center line of the bars to be butt spliced in a straight line.

3.2 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at

right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 03 - CONCRETE

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 QUALIFICATIONS
- 1.4 SPECIAL REQUIREMENTS
- 1.5 GENERAL REQUIREMENTS
 - 1.5.1 Tolerances
 - 1.5.1.1 Floors
 - 1.5.2 Strength Requirements and w/c Ratio
 - 1.5.2.1 Strength Requirements
 - 1.5.2.2 Water-Cement Ratio
 - 1.5.3 Air Entrainment
 - 1.5.4 Slump
 - 1.5.5 Concrete Temperature
 - 1.5.6 Size of Coarse Aggregate
 - 1.5.7 Special Properties and Products
- 1.6 MIXTURE PROPORTIONS
 - 1.6.1 Proportioning Studies for Normal Weight Concrete
 - 1.6.2 Average Compressive Strength Required for Mixtures
 - 1.6.2.1 Computations from Test Records
 - 1.6.2.2 Computations without Previous Test Records
- 1.7 STORAGE OF MATERIALS
- 1.8 GOVERNMENT ASSURANCE INSPECTION AND TESTING
 - 1.8.1 Materials
 - 1.8.2 Fresh Concrete
 - 1.8.3 Hardened Concrete
 - 1.8.4 Inspection

PART 2 PRODUCTS

- 2.1 CEMENTITIOUS MATERIALS
 - 2.1.1 Portland Cement
 - 2.1.2 Blended Cements
 - 2.1.3 Pozzolan (Fly Ash)
 - 2.1.4 Ground Granulated Blast-Furnace (GGBF) Slag
 - 2.1.5 Silica Fume
- 2.2 AGGREGATES
 - 2.2.1 Fine Aggregate
 - 2.2.2 Coarse Aggregate
 - 2.2.3 Materials for Bonded Topping for Heavy Duty Floors

- 2.3 CHEMICAL ADMIXTURES
 - 2.3.1 Air-Entraining Admixture
 - 2.3.2 Accelerating Admixture
 - 2.3.3 Water-Reducing or Retarding Admixture
 - 2.3.4 High-Range Water Reducer
 - 2.3.5 Surface Retarder
 - 2.3.6 Expanding Admixture
 - 2.3.7 Other Chemical Admixtures
- 2.4 CURING MATERIALS
 - 2.4.1 Impervious-Sheet
 - 2.4.2 Membrane-Forming Compound
 - 2.4.3 Burlap and Cotton Mat
- 2.5 WATER
- 2.6 NONSHRINK GROUT
- 2.7 LATEX BONDING AGENT
- 2.8 EPOXY RESIN
- 2.9 EMBEDDED ITEMS
- 2.10 FLOOR HARDENER
- 2.11 PERIMETER INSULATION
- 2.12 VAPOR BARRIER
- 2.13 JOINT MATERIALS
 - 2.13.1 Joint Fillers and Sealers
 - 2.13.2 Contraction Joints in Slabs
- 2.14 DRY SHAKE FLOOR TOPPING MATERIAL

PART 3 EXECUTION

- 3.1 PREPARATION FOR PLACING
 - 3.1.1 Foundations
 - 3.1.1.1 Concrete on Earth Foundations
 - 3.1.1.2 Excavated Surfaces in Lieu of Forms
 - 3.1.2 Previously Placed Concrete
 - 3.1.2.1 Air-Water Cutting
 - 3.1.2.2 High-Pressure Water Jet
 - 3.1.2.3 Wet Sandblasting
 - 3.1.2.4 Waste Disposal
 - 3.1.2.5 Preparation of Previously Placed Concrete
 - 3.1.3 Vapor Barrier
 - 3.1.4 Perimeter Insulation
 - 3.1.5 Embedded Items
- 3.2 CONCRETE PRODUCTION
 - 3.2.1 Batching, Mixing, and Transporting Concrete
 - 3.2.1.1 General
 - 3.2.1.2 Batching Equipment
 - 3.2.1.3 Scales
 - 3.2.1.4 Batching Tolerances
 - 3.2.1.5 Moisture Control
 - 3.2.1.6 Concrete Mixers
 - 3.2.1.7 Stationary Mixers
 - 3.2.1.8 Truck Mixers
- 3.3 TRANSPORTING CONCRETE TO PROJECT SITE
- 3.4 CONVEYING CONCRETE ON SITE
 - 3.4.1 Buckets
 - 3.4.2 Transfer Hoppers

- 3.4.3 Trucks
- 3.4.4 Chutes
- 3.4.5 Belt Conveyors
- 3.4.6 Concrete Pumps
- 3.5 PLACING CONCRETE
 - 3.5.1 Depositing Concrete
 - 3.5.2 Consolidation
 - 3.5.3 Cold Weather Requirements
 - 3.5.4 Hot Weather Requirements
 - 3.5.5 Prevention of Plastic Shrinkage Cracking
 - 3.5.6 Placing Concrete in Congested Areas
 - 3.5.7 Placing Flowable Concrete
- 3.6 JOINTS
 - 3.6.1 Construction Joints
 - 3.6.2 Contraction Joints in Slabs on Grade
 - 3.6.3 Waterstops
 - 3.6.4 Dowels and Tie Bars
- 3.7 FINISHING FORMED SURFACES
 - 3.7.1 Class A Finish and Class B Finish
 - 3.7.2 Class C and Class D Finish
- 3.8 REPAIRS
 - 3.8.1 Damp-Pack Mortar Repair
 - 3.8.2 Repair of Major Defects
 - 3.8.2.1 Surface Application of Mortar Repair
 - 3.8.2.2 Repair of Deep and Large Defects
 - 3.8.3 Resinous and Latex Material Repair
- 3.9 FINISHING UNFORMED SURFACES
 - 3.9.1 General
 - 3.9.2 Rough Slab Finish
 - 3.9.3 Floated Finish
 - 3.9.4 Troweled Finish
 - 3.9.5 Non-Slip Finish
 - 3.9.5.1 Broomed
- 3.10 EXTERIOR SLAB AND RELATED ITEMS
 - 3.10.1 Pavements
 - 3.10.2 Sidewalks
 - 3.10.3 Curbs and Gutters
 - 3.10.4 Pits and Trenches
- 3.11 CURING AND PROTECTION
 - 3.11.1 General
 - 3.11.2 Moist Curing
 - 3.11.3 Membrane Forming Curing Compounds
 - 3.11.4 Impervious Sheeting
 - 3.11.5 Ponding or Immersion
 - 3.11.6 Cold Weather Curing and Protection
- 3.12 SETTING BASE PLATES AND BEARING PLATES
 - 3.12.1 Damp-Pack Bedding Mortar
 - 3.12.2 Nonshrink Grout
 - 3.12.2.1 Mixing and Placing of Nonshrink Grout
 - 3.12.2.2 Treatment of Exposed Surfaces
- 3.13 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL
 - 3.13.1 Grading and Corrective Action
 - 3.13.1.1 Fine Aggregate
 - 3.13.1.2 Coarse Aggregate

- 3.13.2 Quality of Aggregates
- 3.13.3 Scales, Batching and Recording
- 3.13.4 Batch-Plant Control
- 3.13.5 Concrete Mixture
- 3.13.6 Inspection Before Placing
- 3.13.7 Placing
- 3.13.8 Vibrators
- 3.13.9 Curing Inspection
- 3.13.10 Cold-Weather Protection
- 3.13.11 Mixer Uniformity
- 3.13.12 Reports

-- End of Section Table of Contents --

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 117/117R	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214.3R	(1988) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	(1996) Standard Specifications for Structural Concrete
ACI 303R	(1991) Guide to Cast-In-Place Architectural Concrete Practice
ACI 305R	(1991) Hot Weather Concreting
ACI 318/318R	(1999) Building Code Requirements for Structural Concrete and Commentary

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 182	(1991; R 1996) Burlap Cloth Made From Jute or Kenaf
--------------	---

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31/C 31M	(1998) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(19999a) Concrete Aggregates

ASTM C 39	(1996) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42	(1999) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 78	(1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 94	(1999) Ready-Mixed Concrete
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143	(1998) Slump of Hydraulic Cement Concrete
ASTM C 150	(1998a) Portland Cement
ASTM C 171	(1997a) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 173	(1994ael) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192/C 192M	(1998) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997el) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1998) Air-Entraining Admixtures for Concrete
ASTM C 309	(1998a) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	(1999) Chemical Admixtures for Concrete
ASTM C 496	(1996) Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 595	(1998) Blended Hydraulic Cements

ASTM C 595M	(1997) Blended Hydraulic Cements (Metric)
ASTM C 618	(1999) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 685	(1998a) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 937	(1997) Grout Fluidifier for Preplaced-Aggregate Concrete
ASTM C 940	(1998a) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C 989	(1999) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1017	(1998) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1059	(1999) Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C 1064/C 1064M	(1999) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1107	(1999) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1240	(1999) Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar and Grout
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for

Concrete Paving and Structural Construction

ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM E 1155	(1996) Determining Floor Flatness and Levelness Using the F-Number System
ASTM E 1155M	(1996) Determining Floor Flatness and Levelness Using the F-Number System (Metric)

CORPS OF ENGINEERS (COE)

COE CRD-C 94	(1995) Surface Retarders
COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(1997) NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices
------------	--

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1996) Concrete Plant Standards
NRMCA TMMB 100	(1994) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards
NRMCA QC 3	(1984) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Concrete Mix Design, including Test Results; GA.

Written documentation to show that the concrete mix and test results conform to Specification requirement.

SD-13 Certificates

Concrete Materials Certifications; GA.

Written documentation to show that the materials conform to the Specification requirement.

1.3 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

- Concrete Field Testing Technician, Grade I
- Concrete Laboratory Testing Technician, Grade I or II
- Concrete Construction Inspector, Level II

Concrete Transportation Construction Inspector or Reinforced Concrete Special Inspector, Jointly certified by American Concrete Institute (ACI), Building Official and Code Administrators International (BOCA), International Conference of Building Officials (ICBO), and Southern Building Code Congress International (SBCCI).

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

1.4 SPECIAL REQUIREMENTS

A pre-installation meeting with the Contracting Officer will be required at least 10 days prior to start of construction. The Contractor shall be responsible for calling the meeting; the Project Superintendent and active installation personnel shall be present.

1.5 GENERAL REQUIREMENTS

1.5.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.5.1.1 Floors

For the purpose of this Section the following terminology correlation

between ACI 117/117R and this Section shall apply:

Floor Profile Quality Classification From ACI 117/117R	This Section
-----	-----
Conventional Bullfloated	Same
Conventional Straightedged	Same
Flat	Float Finish or Trowel Finish
Very Flat	Same. Use only with F-system

Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

1.5.2 Strength Requirements and w/c Ratio

1.5.2.1 Strength Requirements

Specified compressive strength (f'_c) shall be as follows:

COMPRESSIVE STRENGTH

4000 psi at 28 days

Compressive strength shall be determined in accordance with ASTM C 39.

- a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (6 by 12 inch cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'_c and no individual test result falls below the specified strength f'_c by more than 500 psi. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.
- b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be

considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.

- c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

1.5.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be as follows:

WATER-CEMENT RATIO, BY WEIGHT

0.50

These w/c's may cause higher strengths than that required above for compressive strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations of ACI 211.1 for the term P which is used to denote the weight of pozzolan.

1.5.3 Air Entrainment

All normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 3/4 inch or smaller it shall be between 4.5 and 7.5 percent. Concrete with specified strength over 5000 psi may have 1.0 percent less air than specified above. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C 231.

1.5.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in

accordance with ASTM C 143.

Structural Element	Slump	
	Minimum	Maximum
Walls, columns and beams	2 in.	4 in.
Foundation walls, substructure walls, footings, slabs	1 in.	3 in.
Any structural concrete approved for placement by pumping:		
At pump	2 in.	6 in.
At discharge of line	1 in.	4 in.

When use of a plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C 494 is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added. For troweled floors, slump of structural lightweight concrete with normal weight sand placed by pump shall not exceed 5 inches at the point of placement. For other slabs, slump of lightweight concrete shall not exceed 4 inches at point of placement.

1.5.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 90 degrees F.

When the ambient temperature during placing is 40 degrees F or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 55 and 75 degrees F.

1.5.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

1.5.7 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

1.6 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and

pozzolanic materials as specified, aggregates, water and admixtures as specified.

1.6.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Except as specified for flexural strength concrete, mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in subparagraph Water-Cement Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations in ACI 211.1 for the term P, which is used to denote the weight of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use.

No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192/C 192M. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

1.6.2 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength (f'_{cr}) exceeding the specified compressive strength (f'_c) by the amount indicated below. This

required average compressive strength, f'_{cr} , will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'_{cr} during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'_{cr} , the mixture shall be adjusted, as approved, to bring the daily average back up to f'_{cr} . During production, the required f'_{cr} shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

1.6.2.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths (f'_c) within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'_{cr} used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

$$f'_{cr} = f'_c + 1.34S \text{ where units are in psi}$$

$$f'_{cr} = f'_c + 2.33S - 500 \text{ where units are in psi}$$

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

1.6.2.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'_{cr} shall be determined as follows:

- a. If the specified compressive strength f'_c is less than 3,000 psi,

$$f'_{cr} = f'_c + 1000 \text{ psi}$$

b. If the specified compressive strength f'_c is 3,000 to 5,000 psi,

$$f'_{cr} = f'_c + 1,200 \text{ psi}$$

c. If the specified compressive strength f'_c is over 5,000 psi,

$$f'_{cr} = f'_c + 1,400 \text{ psi}$$

1.7 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

1.8 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

1.8.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.8.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

1.8.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such

tests are considered necessary.

1.8.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, portland-pozzolan cement, or portland cement in combination with pozzolan and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

2.1.1 Portland Cement

ASTM C 150, Type II low alkali including false set requirements or Type V. White portland cement shall meet the above requirements except that it may be Type I, Type II or Type III low alkali.

2.1.2 Blended Cements

ASTM C 595, Type IP.

2.1.3 Pozzolan (Fly Ash)

ASTM C 618, Class F with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618. If pozzolan is used, it shall never be less than 15 percent nor more than 35 percent by weight of the total cementitious material.

2.1.4 Ground Granulated Blast-Furnace (GGBF) Slag

ASTM C 989, Grade 120.

2.1.5 Silica Fume

Silica fume shall conform to ASTM C 1240. Available alkalies shall conform to the optimal limit given in Table 2 of ASTM C 1240. Silica fume may be furnished as a dry, densified material or as a slurry. In accordance with paragraph Technical Service for Specialized Concrete, the Contractor shall provide at no cost to the Government the services of a manufacturer's technical representative experienced in mixing, proportioning, placement procedures, and curing of concrete containing silica fume.

2.2 AGGREGATES

Aggregates shall conform to the following.

2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S, size designation 1 inch.

2.2.3 Materials for Bonded Topping for Heavy Duty Floors

In addition to the requirements specified above, coarse aggregate used for this purpose shall be a well graded, hard, sound diabase, trap rock, emery, granite or other natural or manufactured aggregate having equivalent hardness and wearing qualities and shall have a percentage of loss not to exceed 30 after 500 revolutions when tested in accordance with ASTM C 131. Gradation of the aggregates when tested in accordance with ASTM C 136 shall be as follows:

Coarse Aggregate

Sieve Size	Cumulative Percent By Weight Passing
3/4 in.	100
1/2 in.	50-100
3/8 in.	25-50
No. 4	0-15
No. 8	0-8

Fine Aggregate

Sieve Size	Cumulative Percent By Weight Passing
3/8 in.	100
No. 4	95-100
No. 8	65-80
No. 16	45-65
No. 30	25-45
No. 50	5-15
No. 100	0-5

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.3.1 Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

2.3.2 Accelerating Admixture

ASTM C 494, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

2.3.3 Water-Reducing or Retarding Admixture

ASTM C 494, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

2.3.4 High-Range Water Reducer

ASTM C 494, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.3.5 Surface Retarder

COE CRD-C 94.

2.3.6 Expanding Admixture

Aluminum powder type expanding admixture conforming to ASTM C 937.

2.3.7 Other Chemical Admixtures

Chemical admixtures for use in producing flowing concrete shall comply with ASTM C 1017, Type I or II. These admixtures shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.4 CURING MATERIALS

2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall

contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

2.4.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

2.6 NONSHRINK GROUT

Nonshrink grout shall conform to ASTM C 1107, Grade A, and shall be a commercial formulation suitable for the proposed application.

2.7 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

2.8 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C 881, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

2.9 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel.

2.10 FLOOR HARDENER

Floor hardener shall be a colorless aqueous solution containing zinc silicofluoride, magnesium silicofluoride, or sodium silicofluoride. These silicofluorides can be used individually or in combination. Proprietary hardeners may be used if approved in writing by the Contracting Officer.

2.11 PERIMETER INSULATION

Perimeter insulation shall be polystyrene conforming to ASTM C 578, Type II; polyurethane conforming to ASTM C 591, Type II; or cellular glass conforming to ASTM C 552, Type I or IV.

2.12 VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 6 mils or other equivalent material having a vapor permeance rating not exceeding 0.5 perms as determined in accordance with ASTM E 96.

2.13 JOINT MATERIALS

2.13.1 Joint Fillers and Sealers

Expansion joint fillers shall be preformed materials conforming to ASTM D 1751.

2.13.2 Contraction Joints in Slabs

Sawable type contraction joint inserts shall conform to COE CRD-C 540. Nonsawable joint inserts shall have sufficient stiffness to permit placement in plastic concrete without undue deviation from a straight line and shall conform to the physical requirements of COE CRD-C 540, with the exception of Section 3.4 "Resistance to Sawing". Plastic inserts shall be polyvinyl chloride conforming to the materials requirements of COE CRD-C 572.

2.14 DRY SHAKE FLOOR TOPPING MATERIAL

Dry shake floor topping material shall be a premixed ready-to-use dry shake. It shall be proportioned, mixed and packaged at the factory, and delivered to the jobsite in sealed, moisture resistant bags, ready to apply, finish and cure. The manufacturer of the dry shake material shall have at least 10 years experience in the manufacture of such material. Any material from a manufacturer who makes any disclaimer of the materials performance shall not be used.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03100 STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03200 CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1 Foundations

3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3.1.1.2 Excavated Surfaces in Lieu of Forms

Concrete for footings and walls may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 02300, EARTHWORK. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

3.1.2 Previously Placed Concrete

Concrete surfaces to which additional concrete is to be bonded shall be prepared for receiving the next horizontal lift by cleaning the construction joint surface with either air-water cutting, sandblasting, high-pressure water jet, or other approved method. Concrete at the side of vertical construction joints shall be prepared as approved by the Contracting Officer. Air-water cutting shall not be used on formed surfaces or surfaces congested with reinforcing steel. Regardless of the method used, the resulting surfaces shall be free from all laitance and inferior concrete so that clean surfaces of well bonded coarse aggregate are exposed and make up at least 10-percent of the surface area, distributed uniformly throughout the surface. The edges of the coarse aggregate shall not be undercut. The surface of horizontal construction joints shall be kept continuously wet for the first 12 hours during the 24-hour period prior to placing fresh concrete. The surface shall be washed completely clean as the last operation prior to placing the next lift. For heavy duty floors and two-course floors a thin coat of neat cement grout of about the consistency of thick cream shall be thoroughly scrubbed into the existing surface immediately ahead of the topping placing. The grout shall be a 1:1 mixture of portland cement and sand passing the No. 8 sieve. The topping concrete shall be deposited before the grout coat has had time to stiffen.

3.1.2.1 Air-Water Cutting

Air-water cutting of a fresh concrete surface shall be performed at the proper time and only on horizontal construction joints. The air pressure used in the jet shall be 100 psi plus or minus, 10 psi, and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. When approved by the Contracting Officer, a surface retarder complying with the requirements of COE CRD-C 94 may be applied to the surface of the lift in order to prolong the period of time during which air-water cutting is effective. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, high-pressure waterjet or sandblasting shall be used as the last operation before placing the next lift.

3.1.2.2 High-Pressure Water Jet

A stream of water under a pressure of not less than 3,000 psi shall be used for cutting and cleaning. Its use shall be delayed until the concrete is

sufficiently hard so that only the surface skin or mortar is removed and there is no undercutting of coarse-aggregate particles. If the waterjet is incapable of a satisfactory cleaning, the surface shall be cleaned by sandblasting.

3.1.2.3 Wet Sandblasting

Wet sandblasting shall be used after the concrete has reached sufficient strength to prevent undercutting of the coarse aggregate particles. After wet sandblasting, the surface of the concrete shall then be washed thoroughly to remove all loose materials.

3.1.2.4 Waste Disposal

The method used in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor, or affect exposed surfaces of the structures, or damage the environment of the project area. The method of disposal shall be subject to approval.

3.1.2.5 Preparation of Previously Placed Concrete

Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be thoroughly washed and shall be moist but without free water when concrete is placed.

3.1.3 Vapor Barrier

Vapor barrier shall be provided beneath the interior on-grade concrete floor slabs. The greatest widths and lengths practicable shall be used to eliminate joints wherever possible. Joints shall be lapped a minimum of 12 inches. Torn, punctured, or damaged vapor barrier material shall be removed and new vapor barrier shall be provided prior to placing concrete. For minor repairs, patches may be made using laps of at least 12 inches. Lapped joints shall be sealed and edges patched with pressure-sensitive adhesive or tape not less than 2 inches wide and compatible with the membrane. Vapor barrier shall be placed directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier.

In this case, the surface shall be choked with a light layer of sand, as approved, before placing the vapor barrier. A 2 inch layer of compacted, clean concrete sand (fine aggregate) shall be placed on top of the vapor barrier before placing concrete. Concrete placement shall be controlled so as to prevent damage to the vapor barrier, or any covering sand.

3.1.4 Perimeter Insulation

Perimeter insulation shall be installed at locations indicated. Adhesive shall be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

3.1.5 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 1 foot of the surface of the concrete. Tack welding shall not be performed on or to embedded items.

3.2 CONCRETE PRODUCTION

3.2.1 Batching, Mixing, and Transporting Concrete

Concrete shall either be batched and mixed onsite or shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Concrete shall be batched and mixed onsite, or close to onsite, and shall conform to the following subparagraphs.

3.2.1.1 General

The batching plant shall be located on site or off site close to the project.

The batching, mixing and placing system shall have a capacity of at least 10 cubic yards per hour. The batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

3.2.1.2 Batching Equipment

The batching controls shall be semiautomatic or automatic, as defined in NRMCA CPMB 100. A semiautomatic batching system shall be provided with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. The batching system shall be equipped with accurate recorder or recorders that meet the requirements of NRMCA CPMB 100. The weight of water and admixtures shall be recorded if batched by weight. Separate bins or compartments shall be provided for each size group of aggregate and type of cementitious material, to prevent intermingling at any time. Aggregates shall be weighed either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cementitious material. If both portland cement and other cementitious material are used, they may be batched cumulatively, provided that the portland cement is batched first, except that silica fume shall always be batched separately. Water may be measured by weight or volume. Water shall not be weighed or measured cumulatively with another ingredient. Filling and discharging valves for the water metering or batching system

shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for admixtures shall be free from leaks and shall be properly valved to prevent backflow or siphoning. Admixtures shall be furnished as a liquid of suitable concentration for easy control of dispensing. An adjustable, accurate, mechanical device for measuring and dispensing each admixture shall be provided. Each admixture dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified mixing period. When use of truck mixers makes this requirement impractical, the admixture dispensers shall be interlocked with the sand batchers. Different admixtures shall not be combined prior to introduction in water and shall not be allowed to intermingle until in contact with the cement. Admixture dispensers shall have suitable devices to detect and indicate flow during dispensing or have a means for visual observation. The plant shall be arranged so as to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin or compartment, and for sampling and calibrating the dispensing of cementitious material, water, and admixtures. Filling ports for cementitious materials bins or silos shall be clearly marked with a permanent sign stating the contents.

3.2.1.3 Scales

The weighing equipment shall conform to the applicable requirements of CPMB Concrete Plant Standard, and of NIST HB 44, except that the accuracy shall be plus or minus 0.2 percent of scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring devices. The tests shall be made at the specified frequency in the presence of a Government inspector. The weighing equipment shall be arranged so that the plant operator can conveniently observe all dials or indicators.

3.2.1.4 Batching Tolerances

(A) Tolerances with Weighing Equipment

MATERIAL	PERCENT OF REQUIRED WEIGHT
Cementitious materials	0 to plus 2
Aggregate	plus or minus 2
Water	plus or minus 1
Chemical admixture	0 to plus 6

(B) Tolerances with Volumetric Equipment

For volumetric batching equipment used for water and admixtures, the following tolerances shall apply to the required volume of material being

batched:

MATERIAL	PERCENT OF REQUIRED MATERIAL
Water:	plus or minus 1 percent
Chemical admixtures:	0 to plus 6 percent

3.2.1.5 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched.

3.2.1.6 Concrete Mixers

Mixers shall be stationary mixers or truck mixers. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired.

3.2.1.7 Stationary Mixers

Concrete plant mixers shall be drum-type mixers of tilting, nontilting, horizontal-shaft, or vertical-shaft type, or shall be pug mill type and shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixing time and uniformity shall conform to all the requirements in ASTM C 94 applicable to central-mixed concrete.

3.2.1.8 Truck Mixers

Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of ASTM C 94. A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Each truck shall be equipped with two counters from which it is possible to determine the number of revolutions at mixing speed and the number of revolutions at agitating speed. Water shall not be added at the placing site unless specifically approved; and in no case shall it exceed the specified w/c. Any such water shall be injected at the base of the mixer, not at the discharge end.

3.3 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in truck mixers. Nonagitating equipment, other than pumps, shall not be used for transporting lightweight aggregate concrete.

3.4 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

3.4.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 2 square feet. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yard shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

3.4.2 Transfer Hoppers

Concrete may be charged into nonagitating hoppers for transfer to other conveying devices. Transfer hoppers shall be capable of receiving concrete directly from delivery vehicles and shall have conical-shaped discharge features. The transfer hopper shall be equipped with a hydraulically operated gate and with a means of external vibration to effect complete discharge. Concrete shall not be held in nonagitating transfer hoppers more than 30 minutes.

3.4.3 Trucks

Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94. Nonagitating equipment shall be used only for transporting plant-mixed concrete over a smooth road and when the hauling time is less than 15 minutes. Bodies of nonagitating equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

3.4.4 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

3.4.5 Belt Conveyors

Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means, such as discharge baffle or hopper, for preventing segregation of the

concrete at the transfer points and the point of placing. Belt conveyors shall be constructed such that the idler spacing shall not exceed 36 inches.

The belt speed shall be a minimum of 300 feet per minute and a maximum of 750 feet per minute. If concrete is to be placed through installed horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant truck that is long enough to extend through the reinforcing bars.

3.4.6 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 4 inches. Aluminum pipe shall not be used.

3.5 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

3.5.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete

for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

3.5.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.025 inch, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segregation or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

3.5.3 Cold Weather Requirements

Special protection measures, approved by the Contracting Officer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

3.5.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 85 degrees F, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water or aggregates or placing concrete in the cooler part of

the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature Degrees
Greater than 60	90 F
40-60	85 F
Less than 40	80 F

3.5.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.5.6 Placing Concrete in Congested Areas

Special care shall be used to ensure complete filling of the forms, elimination of all voids, and complete consolidation of the concrete when placing concrete in areas congested with reinforcing bars, embedded items, waterstops and other tight spacing. An appropriate concrete mixture shall be used, and the nominal maximum size of aggregate (NMSA) shall meet the specified criteria when evaluated for the congested area. Vibrators with heads of a size appropriate for the clearances available shall be used, and the consolidation operation shall be closely supervised to ensure complete and thorough consolidation at all points. Where necessary, splices of reinforcing bars shall be alternated to reduce congestion. Where two mats of closely spaced reinforcing are required, the bars in each mat shall be placed in matching alignment to reduce congestion. Reinforcing bars may be temporarily crowded to one side during concrete placement provided they are returned to exact required location before concrete placement and consolidation are completed.

3.5.7 Placing Flowable Concrete

If a plasticizing admixture conforming to ASTM C 1017 is used or if a Type F or G high range water reducing admixture is permitted to increase the slump, the concrete shall meet all requirements of paragraph GENERAL REQUIREMENTS in PART 1. Extreme care shall be used in conveying and placing the concrete to avoid segregation. Consolidation and finishing shall meet all requirements of paragraphs Placing Concrete, Finishing Formed Surfaces, and Finishing Unformed Surfaces. No relaxation of requirements to accommodate flowable concrete will be permitted.

3.6 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 2 inches clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 30 pound asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with Section 07900 JOINT SEALING.

3.6.1 Construction Joints

For concrete other than slabs on grade, construction joints shall be located so that the unit of operation does not exceed 15 feet. Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or

architectural details. Where horizontal construction joints in walls or columns are required, a strip of 1 inch-square-edge lumber, bevelled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

3.6.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by use of rigid inserts impressed in the concrete during placing operations or use of snap-out plastic joint forming inserts. Regardless of method used to produce the weakened plane, it shall be 1/4 the depth of the slab thickness and between 1/8 and 3/16 inch wide. Reservoir for joint sealant shall be formed as previously specified.

3.6.3 Waterstops

Waterstops shall be installed in conformance with the locations and details shown on the drawings using materials and procedures specified in Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

3.6.4 Dowels and Tie Bars

Dowels and tie bars shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section 03200 CONCRETE REINFORCEMENT and herein. Conventional smooth "paving" dowels shall be installed in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance of 1/8 inch in 12 inches. "Structural" type deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

3.7 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section 03100 STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class A or B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/117R. These tolerances apply to the finished concrete surface,

not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

3.7.1 Class A Finish and Class B Finish

Class B finish is required in the following areas, exposed concrete including sumps, containment walls and curbs. Fins, ravelings, and loose material shall be removed, all surface defects over 1/2 inch in diameter or more than 1/2 inch deep, shall be repaired and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Defects more than 1/2 inch in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep. The Contractor shall prepare a sample panel for approval (as specified in PART 1) before commencing repair, showing that the surface texture and color match will be attained. Metal tools shall not be used to finish repairs in Class A surfaces.

3.7.2 Class C and Class D Finish

Class D finish is required where indicated on the drawings. in the following areas, concealed concrete. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 1/2 inch deep or more than 2 inches in diameter shall be repaired. Defects more than 2 inches in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

3.8 REPAIRS

3.8.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 4 inches shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the No. 16 mesh sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into

a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

3.8.2 Repair of Major Defects

Major defects will be considered to be those more than 1/2 inch deep or, for Class A and B finishes, more than 1/2 inch in diameter and, for Class C and D finishes, more than 2 inches in diameter. Also included are any defects of any kind whose depth is over 4 inches or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

3.8.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 2 inches on all sides. All such defective areas greater than 12 square inches shall be outlined by saw cuts at least 1 inch deep. Defective areas less than 12 square inches shall be outlined by a 1 inch deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with

polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

3.8.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 6 inches deep and also have an average diameter at the surface more than 18 inches or that are otherwise so identified by the Project Office. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced. Deep and large defects shall be repaired by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete containing a specified expanding admixture may be used in lieu of the above mixture; the paste portion of such concrete mixture shall be designed to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C 940. A full width "chimney" shall be provided at the top of the form on the placing side to ensure filling to the top of the opening. A pressure cap shall be used on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. The form shall be removed after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the surface of the repair concrete shall be dressed as required.

3.8.3 Resinous and Latex Material Repair

In lieu of the portland cement bonding coats specified above, an epoxy resin or a latex bonding agent may be used.

3.9 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

3.9.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 50 degrees F. In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall

be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

3.9.2 Rough Slab Finish

As a first finishing operation for unformed surfaces and as final finish for slabs to receive mortar setting beds, the surface shall receive a rough slab finish prepared as follows. The following areas depressed slabs shall receive only a rough slab finish. The concrete shall be uniformly placed across the slab area, consolidated as previously specified, and then screeded with straightedge strikeoffs immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible. Side forms and screed rails shall be provided, rigidly supported, and set to exact line and grade. Allowable tolerances for finished surfaces apply only to the hardened concrete, not to forms or screed rails. Forms and screed rails shall be set true to line and grade. "Wet screeds" shall not be used.

3.9.3 Floated Finish

All slabs receiving more than a rough slab finish shall next be given a wood float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 1/4 inch and the water sheen has disappeared, it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Lightweight concrete or concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

3.9.4 Troweled Finish

All slabs, unless indicated otherwise shall be given a triple trowel finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance

with the directions of the machine manufacturer. Additional trowelings shall be performed, either by hand or machine until the surface has been troweled 3 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

3.9.5 Non-Slip Finish

Non-slip floors shall be constructed in accordance with the following subparagraphs.

3.9.5.1 Broomed

The following areas generator and door pads shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a hair push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

3.10 EXTERIOR SLAB AND RELATED ITEMS

3.10.1 Pavements

Pavements shall be constructed where shown on the drawings. After forms are set and underlying material prepared as specified, the concrete shall be placed uniformly throughout the area and thoroughly vibrated. As soon as placed and vibrated, the concrete shall be struck off and screeded to the crown and cross section and to such elevation above grade that when consolidated and finished, the surface of the pavement will be at the required elevation. The entire surface shall be tamped with the strike off, or consolidated with a vibrating screed, and this operation continued until the required compaction and reduction of internal and surface voids are accomplished. Care shall be taken to prevent bringing excess paste to the surface. Immediately following the final consolidation of the surface, the pavement shall be floated longitudinally from bridges resting on the side forms and spanning but not touching the concrete. If necessary, additional concrete shall be placed and screeded, and the float operated until a satisfactory surface has been produced. The floating operation shall be advanced not more than half the length of the float and then continued over the new and previously floated surfaces. After finishing is completed but while the concrete is still plastic, minor irregularities and score marks in the pavement surface shall be eliminated by means of long-handled cutting straightedges. Straightedges shall be 12 feet in length and shall be operated from the sides of the pavement and from bridges. A straightedge operated from the side of the pavement shall be

equipped with a handle 3 feet longer than one-half the width of the pavement. The surface shall then be tested for trueness with a 12 foot straightedge held in successive positions parallel and at right angles to the center line of the pavement, and the whole area covered as necessary to detect variations. The straightedge shall be advanced along the pavement in successive stages of not more than one-half the length of the straightedge. Depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. The straightedge testing and finishing shall continue until the entire surface of the concrete is true. Before the surface sheen has disappeared and well before the concrete becomes nonplastic, the surface of the pavement shall be given a nonslip sandy surface texture by belting with approved "belt" and procedures. Edges and joints shall be rounded with an edger having a radius of 1/8 inch. Curing shall be as specified.

3.10.2 Sidewalks

Concrete shall be 4 inches minimum thickness. Contraction joints shall be provided at 5 feet spaces unless otherwise indicated. Contraction joints shall be cut 1 inch deep with a jointing tool after the surface has been finished. Transverse expansion joints 1/2 inch thick shall be provided at changes in direction and where sidewalk abuts curbs, steps, rigid pavement, or other similar structures. Sidewalks shall be given a lightly broomed finish. A transverse slope of 1/4 inch per foot shall be provided, unless otherwise indicated. Variations in cross section shall be limited to 1/4 inch in 5 feet.

3.10.3 Curbs and Gutters

Concrete shall be formed, placed, and finished by hand using a properly shaped "mule" or constructed using a slipform machine specially designed for this work. Contraction joints shall be cut 3 inches deep with a jointing tool after the surface has been finished. Expansion joints (1/2 inch wide) shall be provided at 100 feet maximum spacing unless otherwise indicated. Exposed surfaces shall be finished using a stiff bristled brush.

3.10.4 Pits and Trenches

Pits and trenches shall be constructed as indicated on the drawings. Bottoms and walls shall be placed monolithically or waterstops and keys, shall be provided as approved.

3.11 CURING AND PROTECTION

3.11.1 General

Concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement	3 days
All other concrete	7 days

Immediately after placement, concrete shall be protected from premature

drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded.

Concrete containing silica fume shall be initially cured by fog misting during finishing, followed immediately by continuous moist curing. Except for plastic coated burlap, impervious sheeting alone shall not be used for curing.

3.11.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

3.11.3 Membrane Forming Curing Compounds

Membrane forming curing compounds shall be used only on surfaces in the following areas, aerated water sump. Concrete in the following areas may be cured with a pigmented curing compound in lieu of moist curing. Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete, including surfaces to which a smooth finish is to be applied or other concrete to be bonded. However, a styrene acrylate or chlorinated rubber compound meeting ASTM C 309, Class B requirements, may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures

with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. All surfaces shall be thoroughly moistened with water. Curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 75 psi, at a uniform coverage of not more than 400 square feet per gallon for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. Surfaces on which clear compound is used shall be shaded from direct rays of the sun for the first 3 days. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

3.11.4 Impervious Sheeting

The following concrete surfaces may be cured using impervious sheets: operation building floor and filter slab. However, except for plastic coated burlap, impervious sheeting alone shall not be used for curing. Impervious-sheet curing shall only be used on horizontal or nearly horizontal surfaces. Surfaces shall be thoroughly wetted and be completely covered with the sheeting. Sheeting shall be at least 18 inches wider than the concrete surface to be covered. Covering shall be laid with light-colored side up. Covering shall be lapped not less than 12 inches and securely weighted down or shall be lapped not less than 4 inches and taped to form a continuous cover with completely closed joints. The sheet shall be weighted to prevent displacement so that it remains in contact with the concrete during the specified length of curing. Coverings shall be folded down over exposed edges of slabs and secured by approved means. Sheets shall be immediately repaired or replaced if tears or holes appear during the curing period.

3.11.5 Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.

3.11.6 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 32 degrees F the temperature of the concrete shall be maintained above 40 degrees F for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 25 degrees F as determined by suitable temperature measuring devices furnished by the Contractor, as required, and installed adjacent to the concrete surface and 2 inches inside the surface of the concrete. The installation of the thermometers shall be made by the

Contractor as directed.

3.12 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with damp-pack bedding mortar, except where nonshrink grout is indicated. The thickness of the mortar or grout shall be approximately $1/24$ the width of the plate, but not less than $3/4$ inch. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed. Nonshrink grout shall be used for base plates.

3.12.1 Damp-Pack Bedding Mortar

Damp-pack bedding mortar shall consist of 1 part cement and 2-1/2 parts fine aggregate having water content such that a mass of mortar tightly squeezed in the hand will retain its shape but will crumble when disturbed.

The space between the top of the concrete and bottom of the bearing plate or base shall be packed with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

3.12.2 Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.12.2.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be maintained at 65 to 85 degrees F until after setting.

3.12.2.2 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back 1 inch and immediately covered with a parge coat of mortar consisting of 1 part portland cement and 2-1/2 parts fine aggregate by weight, with

sufficient water to make a plastic mixture. The parge coat shall have a smooth finish. For other mortars or grouts, exposed surfaces shall have a smooth-dense finish and be left untreated. Curing shall comply with paragraph CURING AND PROTECTION.

3.13 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with ASTM C 1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site.

3.13.1 Grading and Corrective Action

3.13.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C 136 and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall immediately reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

3.13.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C 136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control.

However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

3.13.2 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests for aggregate quality required by ASTM C 33. In addition, after the start of concrete placement, the Contractor shall perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

3.13.3 Scales, Batching and Recording

The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every three months. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, the Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

3.13.4 Batch-Plant Control

The measurement of concrete materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic yard, amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic yard for each class of concrete batched during each day's plant operation.

3.13.5 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C 231 for normal weight concrete and ASTM C 173 for lightweight concrete. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the

current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph Air Entrainment. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixer controlled as directed.

- b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.
- c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with ASTM C 143 for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall

immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 1/2 inch below the maximum allowable slump specified in paragraph Slump in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 2 inches. Samples for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

- d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.
- e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064/C 1064M. The temperature shall be reported along with the compressive strength data.
- f. Strength Specimens. At least one set of test specimens shall be made, for compressive or flexural strength as appropriate, on each different concrete mixture placed during the day for each 500 cubic yards or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is

done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. Test specimens shall be molded and cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39 for test cylinders and ASTM C 78 for test beams. Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in paragraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

3.13.6 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.13.7 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.13.8 Vibrators

The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Any vibrator not meeting the requirements of paragraph Consolidation, shall be immediately removed from service and repaired or replaced.

3.13.9 Curing Inspection

- a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.
- b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.
- c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square feet per gallon, and shall note whether or not coverage is uniform.
- d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.
- e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.
- f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

3.13.10 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.13.11 Mixer Uniformity

- a. Stationary Mixers. Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 75,000 cubic yards of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be determined in accordance with ASTM C 94.
- b. Truck Mixers. Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94. The truck mixers shall be selected randomly for testing. When

satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.

- c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

3.13.12 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 04 - MASONRY

SECTION 04200

MASONRY

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, HANDLING, AND STORAGE
 - 1.3.1 Masonry Units
 - 1.3.2 Reinforcement, Anchors, and Ties
 - 1.3.3 Cementitious Materials, Sand and Aggregates

PART 2 PRODUCTS

- 2.1 GENERAL REQUIREMENTS
- 2.2 CONCRETE MASONRY UNITS (CMU)
 - 2.2.1 Aggregates
 - 2.2.2 Kinds and Shapes
 - 2.2.2.1 Architectural Units
- 2.3 MORTAR
 - 2.3.1 Admixtures
 - 2.3.2 Coloring
- 2.4 GROUT
 - 2.4.1 Admixtures
 - 2.4.2 Grout Barriers
- 2.5 ANCHORS, TIES, AND BAR POSITIONERS
 - 2.5.1 Wire Mesh Ties
 - 2.5.2 Wall Ties
 - 2.5.3 Dovetail Anchors
 - 2.5.4 Adjustable Anchors
 - 2.5.5 Bar Positioners
- 2.6 REINFORCING STEEL BARS AND RODS
- 2.7 CONTROL JOINT KEYS
- 2.8 EXPANSION-JOINT MATERIALS
- 2.9 FLASHING

PART 3 EXECUTION

- 3.1 ENVIRONMENTAL REQUIREMENTS
 - 3.1.1 Hot Weather Installation
 - 3.1.2 Cold Weather Installation
 - 3.1.2.1 Preparation
 - 3.1.2.2 Completed Masonry and Masonry Not Being Worked On
- 3.2 LAYING MASONRY UNITS

- 3.2.1 Surface Preparation
- 3.2.2 Forms and Shores
- 3.2.3 Concrete Masonry Units
- 3.2.4 Tolerances
- 3.2.5 Cutting and Fitting
- 3.2.6 Jointing
 - 3.2.6.1 Flush Joints
 - 3.2.6.2 Tooled Joints
 - 3.2.6.3 Door and Window Frame Joints
- 3.2.7 Joint Widths
 - 3.2.7.1 Concrete Masonry Units
- 3.2.8 Embedded Items
- 3.2.9 Unfinished Work
- 3.2.10 Masonry Wall Intersections
- 3.2.11 Partitions
- 3.3 MORTAR
- 3.4 REINFORCING STEEL
 - 3.4.1 Positioning Bars
 - 3.4.2 Splices
- 3.5 PLACING GROUT
 - 3.5.1 Vertical Grout Barriers for Fully Grouted Walls
 - 3.5.2 Horizontal Grout Barriers
 - 3.5.3 Grout Holes and Cleanouts
 - 3.5.3.1 Grout Holes
 - 3.5.3.2 Cleanouts for Hollow Unit Masonry Construction
 - 3.5.4 Grouting Equipment
 - 3.5.4.1 Grout Pumps
 - 3.5.4.2 Vibrators
 - 3.5.5 Grout Placement
 - 3.5.5.1 Low-Lift Method
 - 3.5.5.2 High-Lift Method
- 3.6 BOND BEAMS
- 3.7 CONTROL JOINTS
- 3.8 LINTELS
 - 3.8.1 Masonry Lintels
- 3.9 SILLS AND COPINGS
- 3.10 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL
 - 3.10.1 Anchorage to Concrete
- 3.11 CONCRETE SPLASH BLOCKS
 - 3.11.1 Splash Block
 - 3.11.2 Fastener
- 3.12 POINTING AND CLEANING
 - 3.12.1 Concrete Masonry Unit Surfaces Surfaces
- 3.13 BEARING PLATES
- 3.14 PROTECTION

-- End of Section Table of Contents --

SECTION 04200

MASONRY

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI SP-66 (1994) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82	(1997a) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 153/A 153M	(1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 615/A 615M	(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 90	(1998) Loadbearing Concrete Masonry Units
ASTM C 91	(1998) Masonry Cement
ASTM C 270	(1997a) Mortar for Unit Masonry
ASTM C 476	(1998) Grout for Masonry
ASTM C 494	(1998) Chemical Admixtures for Concrete
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 641	(1982; R 1991) Staining Materials in Lightweight Concrete Aggregates
ASTM C 780	(1996) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 1019	(1989a; R 1998) Sampling and Testing Grout

ASTM C 1072	(1998) Measurement of Masonry Flexural Bond Strength
ASTM C 1289	(1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 2000	(1998c) Rubber Products in Automotive Applications
ASTM D 2240	(1997e1) Rubber Property - Durometer Hardness
ASTM D 2287	(1996) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Concrete Masonry Units; FIO

Manufacturer's descriptive data.

SD-13 Certificates

Manufacturer's Certification; FIO

Manufacturer's certification that masonry units were manufactured and wet cured for 28 days prior to delivery.

SD-14 Samples

Concrete Masonry Units (CMU); FIO

Color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture.

1.3 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

1.3.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather and shall conform to the moisture content as specified in ASTM C 90 when delivered to the jobsite.

1.3.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, and ties shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.3.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

2.2 CONCRETE MASONRY UNITS (CMU)

Hollow and solid concrete masonry units shall conform to ASTM C 90, Type I. Cement shall have a low alkali content and be of one brand.

2.2.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

2.2.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 1 inch. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color. Units shall be integrally colored to match architectural units.

2.2.2.1 Architectural Units

Units shall have patterned face shell. Face shell pattern shall be split-faced. Units shall be integrally colored during manufacture. Color shall be per Section 09915. Patterned face shell shall be properly aligned in the completed wall.

2.3 MORTAR

Mortar shall be Type S in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; when masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C 780 and ASTM C 1072. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.3.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494, Type C.

2.3.2 Coloring

Mortar coloring shall be added to the mortar used for exposed masonry surfaces to produce a uniform color matching Color Schedule. Mortar coloring shall not exceed 3 percent of the weight of cement for carbon black and ten percent of the weight of cement for all other pigments. Mortar coloring shall be chemically inert, of finely ground limeproof pigment, and furnished in accurately pre-measured and packaged units that can be added to a measured amount of cement.

2.4 GROUT

Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 10 inches. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

2.4.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494, Type C.

2.4.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.5 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153/A 153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to

ASTM A 82. Anchors and ties shall be sized to provide a minimum of 5/8 inch mortar cover from either face.

2.5.1 Wire Mesh Ties

Wire mesh for tying 4 inch thick concrete masonry unit partitions to other intersecting masonry partitions shall be 1/2 inch mesh of minimum 16 gauge steel wire. Minimum lengths shall be not less than 12 inches.

2.5.2 Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 3/16 inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4 inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 3/16 inch diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 1/2 inch eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 1/16 inch. The pintle and eye elements shall be formed so that both can be in the same plane.

2.5.3 Dovetail Anchors

Dovetail anchors shall be of the flexible wire type, 3/16 inch diameter zinc-coated steel wire, triangular shaped, and attached to a 12 gauge or heavier steel dovetail section. These anchors shall be used for anchorage of veneer wythes or composite-wall facings extending over the face of concrete columns, beams, or walls. Cells within vertical planes of these anchors shall be filled solid with grout for full height of walls or partitions, or solid units may be used. Dovetail slots are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.5.4 Adjustable Anchors

Adjustable anchors shall be 3/16 inch diameter steel wire, triangular-shaped. Anchors attached to steel shall be 5/16 inch diameter steel bars placed to provide 1/16 inch play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

2.5.5 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.6 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615/A 615M, Grade 60.

2.7 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000 or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 5/8 inch thick and 3/8 inch thick flanges, with a tolerance of plus or minus 1/16 inch. The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 30 degrees F after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

2.8 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07900 JOINT SEALING.

2.9 FLASHING

Flashing shall be as specified in Section 07600 SHEET METALWORK, GENERAL.

PART 3 EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

3.1.2.1 Preparation

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

- a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F.
- b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.
- c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 degrees F and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.
- d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 degrees F and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

- a. Mean daily air temperature 40 degrees F to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.
- b. Mean daily air temperature 32 degrees F to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.
- c. Mean Daily Air Temperature 25 Degrees F to 20 Degrees F. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.
- d. Mean Daily Temperature 20 Degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 1/2 inch. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other

imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Units shall be shoved into place so that the vertical joints are tight. Vertical face shells of concrete masonry units, except where indicated at control, joint, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below.

3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 1/8 inch. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.2 Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.3 Concrete Masonry Units

Units in piers, starting courses on footings, solid foundation walls, lintels, and beams, and all cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Jamb units shall be of the shapes and sizes to conform with wall units. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines
and surfaces of columns, walls and arises

In adjacent masonry units

1/8 inch

TOLERANCES

In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variations from the plumb for external corners,
expansion joints, and other conspicuous lines

In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from the level for exposed lintels,
sills, parapets, horizontal grooves, and other
conspicuous lines

In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variation from level for bed joints and top
surfaces of bearing walls

In 10 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from horizontal lines

In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variations in cross sectional dimensions of
columns and in thickness of walls

Minus	1/4 inch
Plus	1/2 inch

3.2.5 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above

openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.6 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.6.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

3.2.6.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.6.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

3.2.7 Joint Widths

Joint widths shall be as follows:

3.2.7.1 Concrete Masonry Units

Concrete masonry units shall have 3/8 inch joints, except for prefaced concrete masonry units.

3.2.8 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and joint reinforcement shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

3.2.9 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Tothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

3.2.10 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.2.11 Partitions

Partitions shall be continuous from floor to underside of roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 4 inches above the ceiling level.

3.3 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2 hours after mixing shall be discarded.

3.4 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

3.4.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the

vertical reinforcement and shall not be placed in horizontal bed joints.

3.4.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.5 PLACING GROUT

All cells shall be filled with grout. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

3.5.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.5.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

3.5.3 Grout Holes and Cleanouts

3.5.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located as required to facilitate grout fill in bond beams. Openings shall not be less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

3.5.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 32 inches where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.5.4 Grouting Equipment

3.5.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

3.5.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

3.5.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

3.5.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.5.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in

the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2)			
	Grout Type	Grouting Procedure	Multiwythe Masonry (3)	Hollow-unit Masonry
1	Fine	Low Lift	3/4	1-1/2 x 2
5	Fine	Low Lift	2	2 x 3
8	Fine	High Lift	2	2 x 3
12	Fine	High Lift	2-1/2	2-1/2 x 3
24	Fine	High Lift	3	3 x 3
1	Coarse	Low Lift	1-1/2	1-1/2 x 3
5	Coarse	Low Lift	2	2-1/2 x 3
8	Coarse	High Lift	2	3 x 3
12	Coarse	High Lift	2-1/2	3 x 3
24	Coarse	High Lift	3	3 x 4

Notes:

- (1) The actual grout space or cell dimension must be larger than the sum of the following items:
 - a) The required minimum dimensions of total clear areas given in the table above;
 - b) The width of any mortar projections within the space;
 - c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.

- (2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.
- (3) For grouting spaces between masonry wythes.
- (4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.6 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

3.7 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using special control-joint units in accordance with the details shown on the Drawings. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 3/4 inch; backer rod and sealant shall be installed in accordance with Section 07900 JOINT SEALING. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

3.8 LINTELS

3.8.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 1/2 inch above the bottom inside surface of the lintel unit.

3.9 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

3.10 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.10.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 16 inches on centers vertically and 24 inches on center horizontally.

3.11 CONCRETE SPLASH BLOCKS

3.11.1 Splash Block

Nominal 4 feet by 2 feet by 6 inches thick, precast concrete with #6 wire mesh reinforcing. Slope the upper surface of the block to drain rainwater away from the building. Provide a splash block at each rainwater downspout terminus at grade.

3.11.2 Fastener

Galvanized 3/8-inch minimum diameter by 10-inch minimum long spike or reinforcing bar. Two spikes per splash block.

3.12 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

3.12.1 Concrete Masonry Unit Surfaces

Exposed concrete masonry unit and concrete brick surfaces shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.13 BEARING PLATES

Bearing plates for beams, joists, joist girders and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar and non-shrink grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.14 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is

not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 05 - METALS

SECTION 05120

STRUCTURAL STEEL

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS
- 1.4 STORAGE
- 1.5 WELDING INSPECTOR

PART 2 PRODUCTS

- 2.1 STRUCTURAL STEEL
 - 2.1.1 Carbon Grade Steel
 - 2.1.2 Structural Shapes for Use in Building Framing
- 2.2 HIGH STRENGTH BOLTS AND NUTS
- 2.3 CARBON STEEL BOLTS AND NUTS
- 2.4 NUTS DIMENSIONAL STYLE
- 2.5 PAINT

PART 3 EXECUTION

- 3.1 FABRICATION
- 3.2 ERECTION
 - 3.2.1 Structural Connections
 - 3.2.2 Base Plates and Bearing Plates
 - 3.2.3 Field Priming
- 3.3 WELDING

-- End of Section Table of Contents --

SECTION 05120

STRUCTURAL STEEL

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC FCD	(1995a) Quality Certification Program Description
AISC ASD Manual	(1989) Manual of Steel Construction Allowable Stress Design
AISC ASD/LRFD Vol II	(1992) Manual of Steel Construction Vol II: Connections
AISC Design Guide No. 10	(1989) Erection Bracing of Low-Rise Structural Steel Frames
AISC LRFD Vol I	(1995) Manual of Steel Construction Load & Resistance Factor Design, Vol I: Structural Members, Specifications & Codes
AISC LRFD Vol II	(1995) Manual of Steel Construction Load & Resistance Factor Design, Vol II: Structural Members, Specifications & Codes
AISC Pub No. S303	(1992) Code of Standard Practice for Steel Buildings and Bridges

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 6/A 6M	(1998a) General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A 36/A 36M	(1997a) Carbon Structural Steel
ASTM A 307	(1997) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 325	(1997) Structural Bolts, Steel, Heat

	Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 563	(1997) Carbon and Alloy Steel Nuts
ASTM A 563M	(1997) Carbon and Alloy Steel Nuts (Metric)
ASTM A 572/A 572M	(1999) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588/A 588M	(1997) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 618	(1999) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A 709/A 709M	(1997a) Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy Structural Steel Plates for Bridges
ASTM A 852/A 852M	(1997) Quenched and Tempered Low-Alloy Structural Steel Plate with 70 ksi (485 MPa) Minimum Yield Strength to 4 in. (100 mm) Thick
ASTM A 992/A 992M	(1998e1) Steel for Structural Shapes For Use in Building Framing

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.21.1	(1994) Lock Washers (Inch Series)
ASME B46.1	(1995) Surface Texture (Surface Roughness, Waviness, and Lay)

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1998) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1	(1998) Structural Welding Code - Steel

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)
---------------	--

1.2 GENERAL REQUIREMENTS

Structural steel fabrication and erection shall be performed by an organization experienced in structural steel work of equivalent magnitude.

The Contractor shall be responsible for correctness of detailing, fabrication, and for the correct fitting of structural members. Connections, for any part of the structure not shown on the contract drawings, shall be considered simple shear connections and shall be designed and detailed in accordance with pertinent provisions of AISC ASD Manual and AISC LRFD Vol II. Substitution of sections or modification of connection details will not be accepted unless approved by the Contracting Officer. AISC ASD Manual shall govern the work. Welding shall be in accordance with AWS D1.1. High-strength bolting shall be in accordance with AISC ASD Manual.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Structural Connections; GA.

Shop and erection details including members (with their connections) not shown on the contract drawings. Welds shall be indicated by standard welding symbols in accordance with AWS A2.4.

SD-13 Certificates

Mill Test Reports; FIO.

Certified copies of mill test reports for structural steel, structural bolts, nuts, washers and other related structural steel items, including attesting that the structural steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified, prior to the installation.

Welder Qualifications; FIO.

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

1.4 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

1.5 WELDING INSPECTOR

Welding Inspector qualifications shall be in accordance with AWS D1.1

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

2.1.1 Carbon Grade Steel

Carbon grade steel shall conform to ASTM A 36/A 36M.

2.1.2 Structural Shapes for Use in Building Framing

Wide flange shapes in accordance with ASTM A 992/A 992M shall be used where indicated on the drawings.

2.2 HIGH STRENGTH BOLTS AND NUTS

High strength bolts shall conform to ASTM A 325, Type 1 with carbon steel nuts conforming to ASTM A 563.

2.3 CARBON STEEL BOLTS AND NUTS

Carbon steel bolts shall conform to ASTM A 307, Grade A with carbon steel nuts conforming to ASTM A 563, Grade A.

2.4 NUTS DIMENSIONAL STYLE

Carbon steel nuts shall be Hex style when used with ASTM A 307 bolts or Heavy Hex style when used with ASTM A 325.

2.5 PAINT

Paint shall conform to SSPC Paint 25.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC ASD Manual. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be certified under the AISC FCD for Category E structural steelwork. Compression joints depending on contact bearing shall have a surface roughness not in excess of 500 micro inches as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A 6/A 6M.

3.2 ERECTION

3.2.1 Structural Connections

Anchor bolts and other connections between the structural steel and foundations shall be provided and shall be properly located and built into connecting work. Field welded structural connections shall be completed before load is applied.

3.2.2 Base Plates and Bearing Plates

Column base plates for columns and bearing plates for beams, girders, and similar members shall be provided. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed

and properly positioned, but prior to placing superimposed loads. Separate setting plates under column base plates will not be permitted. The area under the plate shall be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.2.3 Field Priming

After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

3.3 WELDING

The contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 05 - METALS

SECTION 05500

MISCELLANEOUS METAL

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 GENERAL REQUIREMENTS
- 1.4 DISSIMILAR MATERIALS
- 1.5 WORKMANSHIP
- 1.6 ANCHORAGE
- 1.7 SHOP PAINTING

PART 2 PRODUCTS

- 2.1 CUSTOM DOOR STOP/HOLDER
- 2.2 LADDERS
- 2.3 MISCELLANEOUS
- 2.4 ROLL-UP STEEL DOOR FRAMES

PART 3 EXECUTION

- 3.1 GENERAL INSTALLATION REQUIREMENTS
- 3.2 INSTALLATION OF CUSTOM DOOR STOP/HOLDER
- 3.3 DOOR FRAMES

-- End of Section Table of Contents --

SECTION 05500

MISCELLANEOUS METAL

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.3	(1992) Ladders - Fixed - Safety Requirements
ANSI MH28.1	(1982) Design, Testing, Utilization, and Application of Industrial Grade Steel Shelving

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997ael) Carbon Structural Steel
ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 123/A 123M	(1997ael) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 283/A 283M	(1998) Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A 467/A 467M	(1998) Machine and Coil Chain
ASTM A 475	(1998)

Zinc-Coated Steel Wire Strand

ASTM A 500 (1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A 653/A 653M (1999) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M (1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM B 26/B 26M (1998) Aluminum-Alloy Sand Castings

ASTM B 221 (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM B 221M (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

ASTM B 429 (1995) Aluminum-Alloy Extruded Structural Pipe and Tube

ASTM D 2047 (1993) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine

ASTM F 1267 (1997) Metal, Expanded, Steel

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (1995) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (1998) Structural Welding Code - Steel

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-344 (Rev B) Lacquer, Clear Gloss, Exterior, Interior

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531 (1994) Metal Bar Grating Manual

NAAMM MBG 532 (1994) Heavy Duty Metal Bar Grating Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211 (1996; Errata 96-1) Chimneys, Fireplaces,
Vents and Solid Fuel-Burning Appliances

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Miscellaneous Metal Items; FIO.

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates.

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M, ASTM A 653/A 653M, or ASTM A 924/A 924M, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be

accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

1.7 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

PART 2 PRODUCTS

2.1 CUSTOM DOOR STOP/HOLDER

Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53, Type E or S, weight STD, galvanized finish.

2.2 LADDERS

Ladders shall be galvanized steel fixed rail type in accordance with ANSI A14.3.

2.3 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

2.4 ROLL-UP STEEL DOOR FRAMES

Steel door frames built from structural shapes shall be neatly mitered and securely welded at the corners with all welds ground smooth. Jambs shall be provided with 2 by 1/4 by 12 inch bent, adjustable metal anchors spaced not over 2 feet 6 inches on centers. Provision shall be made to stiffen the top member for all spans over 3 feet. Continuous door stops shall be made of 1-1/2 by 5/8 inch bars.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional

procedures as specified.

3.2 INSTALLATION OF CUSTOM DOOR STOP/HOLDER

Door stop/holder shall be set vertically in concrete slab. Concrete for slab is specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.3 DOOR FRAMES

Door frames shall be secured to the floor slab by means of angle clips and expansion bolts. Continuous door stops shall be welded to the frame or tap screwed with countersunk screws at no more than 18 inchcenters, assuring in either case full contact with the frame. Any necessary reinforcements shall be made and the frames shall be drilled and tapped as required for hardware.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 06 - WOODS & PLASTICS

SECTION 06610

FIBERGLASS REINFORCED PANELS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUMMARY
- 1.3 SUBMITTALS
- 1.4 INSTALLER 'S RESPONSIBILITY
- 1.5 QUALITY ASSURANCE
- 1.6 DELIVERY, STORAGE AND HANDLING
- 1.7 PROJECT CONDITIONS
- 1.8 WARRANTY
- 1.9 MAINTENANCE

PART 2 PRODUCTS

- 2.1 MATERIALS

PART 3 EXECUTION

- 3.1 EXAMINATION
- 3.2 INSTALLATION
- 3.3 CLEANING
- 3.4 PROTECTION

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 06610

FIBERGLASS REINFORCED PANELS

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

D2583	Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
D256	Pendulum Impact Resistance of Notched Specimens of Plastics
D570	Water Absorption of Plastics
D638	Tensile Properties of Plastics
D695	Compressive Properties of Rigid Plastics
D696	Coefficient of Linear Thermal Expansion of Plastics Between -30C and 30C
D790	Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
D792	Density and Specific Gravity of Plastics by Displacement
D1929	Ignition Properties of Plastics
E84	Surface Burning Characteristics of Building Materials

1.2 SUMMARY

- A. Provide fiberglass reinforced panel (FRP) wainscot in areas indicated on Drawings.
- B. Provide trim and fasteners for the FRP wainscot.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Warranty; FIO.

Manufacturer's standard written guarantees.

SD-13 Certificates

Certificates of Compliance; FIO.

Submit all certified test reports that FRP meets required testing standards.

SD-14 Samples

Samples; FIO.

12-inch by 18-inch minimum size of specified color for each type.

1.4 INSTALLER 'S RESPONSIBILITY

A. Substrate: The Installer must examine the substrate, and the conditions under which the FRP is to be installed, and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

1.5 QUALITY ASSURANCE

A. All FRP shall be a standard and continuing product in the manufacturer's line and shall be identified by regular name or model numbers in the manufacturer's folders or brochures and shall not be a custom run for the project. The FRP shall be available from the manufacturer's normal distribution outlets within the State.

B. Experience of installer shall be at least three years in the supervision of FRP installation on wall surfaces.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all FRP and trim in original factory wrappings. Store under cover in well-ventilated spaces as soon as delivered. Protect from damage, dirt, stains, and moisture.

1.7 PROJECT CONDITIONS

A. Maintain spaces to receive FRP at 70 degrees F minimum at floor level

for 48 hours previous to, during, and for 48 hours after installation.

1.8 WARRANTY

A. The Contractor shall guarantee that the FRP and other materials supplied shall be as specified and shall further guarantee them against defects in design, materials, construction ten years and workmanship for a period of two years, starting on the first day of acceptance. All work that becomes defective during guarantee period shall be repaired or replaced to the satisfaction of the Government.

B. The Contractor shall replace defective materials and repair installation deficiencies within 30 days after being notified by the Government.

1.9 MAINTENANCE

A. FRP manufacturer's recommended maintenance procedures.

PART 2 PRODUCTS

2.1 MATERIALS

A. Acceptable Manufacturers:

1. Nudo products Inc., NP Polymer Light,
2. Lasco Composites LP,
3. Glass Steel,
4. or equal.

B. FRP Specification: The specifications are based on specific performance requirements for quality, durability and design.

1. Minimum Thickness: .050" thick.
2. Barcol Hardness: 35 Avg. in accordance with ASTM D2583-934-1.
3. Flexural Strength: 17,000 P.S.I. minimum in accordance with ASTM D790.
4. Flexural Modulus: 6.9×10^5 P.S.I. minimum in accordance with ASTM D790.
5. Compressive Strength: 19,000 P.S.I. minimum in accordance with ASTM D695.
6. Compressive Modulus: 8.1×10^5 P.S.I. minimum in accordance with ASTM D695.
7. Tensile Strength: 12,000 P.S.I. minimum in accordance with ASTM D638.
8. Tensile Modulus: 9.43×10^5 P.S.I. minimum in accordance with ASTM D638.
9. Elongation: 1.7% maximum in accordance with ASTM D638.
10. Ignition Temperature: 650° F+ minimum in accordance with ASTM D1929.
11. Water Absorption: .4% at 72 Hrs. maximum in accordance with ASTM D570.
12. IZOD Impact: 6.0 Ft.-Lbs./In. minimum in accordance with ASTM D256.
13. Flame Spread Index: 25 maximum in accordance with ASTM E84-81A.
14. Smoke Developed Value: 335 maximum in accordance with ASTM

E84-81A.

15. Thermal Expansion: 1.5×10^{-5} IN/IN/°F maximum in accordance with ASTM D696.

16. Specific Gravity: 1.5 minimum in accordance with ASTM D792.

C. Trim: Manufacturer's standard PVC or aluminum trim. Provide trim at all joints and edges, including base of panels.

D. Adhesive: As recommended by the panel manufacturer.

E. Fasteners: Non-corrosive, finished to match panel color.

F. Color and Finish: As selected from manufacturer's standard range, see Section 09915. Finish shall be a pebble textured type surface.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to installation of the work of this Section, carefully inspect and verify that the installed work of all other trades is complete to the point where this installation may properly commence.

B. Verify that specified items may be installed in accordance with the approved design.

C. In the event of discrepancy, immediately notify the Contracting Officer. Do not proceed in discrepant areas until discrepancies have been fully resolved.

D. Surfaces to receive FRP shall be in conditions satisfactory to installer. Moisture conditions of surfaces should be considered in selecting adhesive to provide proper bond between the substrate and FRP.

3.2 INSTALLATION

A. FRP shall be adhesively applied to the substrate. Trim shall be mechanically fastened with concealed fasteners whenever possible. Use adhesive where concealed fasteners for the trim cannot be installed.

B. Cut opening for all junction boxes, pipes, accessories in the FRP proper to installation. Cut outs shall be straight and edges sanded smooth.

C. Apply trim at all panel edges and joints, unless the edge or joint is concealed.

3.3 CLEANING

A. Clean the RFP of all-adhesive spots and similar soil.

3.4 PROTECTION

A. Protect installed RFP from damage by other trades. Replace damaged material to the satisfaction of the Government.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07190

WATER REPELLENT SEALER

03/01

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 SUBMITTALS
- 1.3 QUALITY ASSURANCE
- 1.4 DELIVERY, STORAGE AND HANDLING
- 1.5 COORDINATION
- 1.6 SPECIAL GUARANTEE

PART 2 PRODUCTS

- 2.1 SEALER

PART 3 EXECUTION

- 3.1 APPLICATION OF CLEAR SEALER

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 07190

WATER REPELLENT SEALER

03/01

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. A clear water repellent sealer application to vertical surfaces of exposed above grade exterior concrete where indicated and all exterior and interior concrete unit masonry (CMU) surfaces.

B. Locations for clear water repellent sealer:

1. Operations Building: All vertical surfaces of interior unpainted concrete and CMU
2. Operations Building: Exterior vertical CMU that does not receive Anti-Graffiti coating.

C. Related Sections:

1. Section 03300: Cast-In-Place Concrete
2. Section 04200: Concrete Unit Masonry
3. Section 07900: Joint Sealants
4. Section 09900: Painting
5. Section 09960: Protective Coatings

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Product Data; FIO.

Fully describe all products proposed for use. Include Material Information Sheet for all products.

SD-08 Statements

Warranty; FIO.

Manufacturer's five-year warranty for Water Repellent Sealer.

1.3 QUALITY ASSURANCE

- A. Qualifications: Apply water repellent sealer by a licensed Waterproofing Specialty Contractor (California License No. C61 Waterproofing and Sealant Work) exclusively engaged in applying waterproofing materials, sealers and sealants.
- B. Regulatory Requirements: Comply with the 1998 California Building Code and referenced Uniform Building Code (UBC).
- C. Trade Association Recommendations:
 - 1. Comply with recommendations on waterproofing contained in the "Masonry Design Manual" published by the Masonry Industry Advancement Committee.
 - 2. Comply with the Portland Cement Association recommendations for waterproofing architectural concrete.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver material in labeled unopened containers.
- B. Store all material on raised platforms protected from moisture and from contamination by dirt, mud or other foreign material.

1.5 COORDINATION

- A. Coordinate with other trades whose work may be damaged by sealer application.
- B. Protect glass and other finished surfaces with polyethylene sheeting taped in place.

1.6 SPECIAL GUARANTEE

- A. Apply sealer under the supervision of the sealer manufacturer's representative.
- B. Provide a signed five (5) year Special Guarantee, signed by the sealer manufacturer, applicator and Contractor against sealer's failure to prevent water intrusion through the treated masonry or concrete.

PART 2 PRODUCTS

2.1 SEALER

- A. Material:
 - 1. Waterbased, penetrating clear water repellent sealer designed for lightweight concrete block and architectural concrete.
 - 2. Not less than 18% solids content.
 - 3. Meet requirements of Air Quality Management District having jurisdiction.
 - 4. Manufacturer: HYDROZO Enviroseal Double "7" H.D, by ChemRex Inc. or equal. Specifier knows of no equal.
- B. Performance Requirements:
 - 1. Water vapor transmission, ASTM E 96; Results: 80% minimum as

compared to untreated samples.

2. Percent reduction of leakage, ASTM E 514-90; Results: CMU walls 98.9% (minimum).
3. Percent Active Ingredients - no less than 18%.
4. V.O.C. content; less than 400 grams/liter.
5. Density; 8.3 +/- 0.1 lb./gal.
6. Flash Point: ASTM D 3278-82; Results: Greater than 212 degrees F.
7. Water Repellency Test: ASTM C 140; Results: 98.5% (minimum).
8. Depth of Penetration: Up to 3/8" (depending upon substrate).

PART 3 EXECUTION

3.1 APPLICATION OF CLEAR SEALER

- A. Apply sealer after concrete and masonry has cured at least 30 days, and after the concrete and the masonry has been cleaned.
- B. Prior to applying sealer clean down all masonry and architectural concrete by scrubbing with water and masonry or concrete cleaner and bristle brushes.
- C. Inspect surface for cracks. Rout out all cracks 5 mils and wider and fill with a high performance joint sealant having a 20-year life expectancy and recommended by the water repellent sealer manufacturer for use on substrates to be sealed with his sealer. Perform joint sealant work in accordance with Section 07900.
- D. Spray-Apply Sealer: Use airless spray equipment with recirculating type pump and perforated T-bar applicator recommended by the sealer manufacturer. DO NOT USE pressure pot spray equipment. Operate at lowest possible pressures, 20 psi maximum. Do not allow fogging or bounce-off except on tension break coat.
- E. Protect surfaces that are not to be coated. Cover all items not scheduled to receive the sealer, such as glass, guardrails, anodized aluminum, doors, windows, louvers, and equipment with polyethylene sheeting; continuously seal all edges with tape.
- F. Apply sealer material in accordance with manufacturer's instructions. Apply at the rate recommended by the manufacturer for the density, porosity and texture of concrete and/or concrete block used. Apply enough sealer so the masonry surface appears uniformly wet, for each coat, for from two to five hours after application.
 1. Rate of Application: Coverage as recommended by the manufacturer for porous concrete block but coverage shall not exceed 40 square feet per gallon for the first coat and 70 square feet per gallon for the second coat.
 2. First Coat: Apply the first coat in two passes: the first pass, a light spray to break surface tension; the second pass, a full flood coat applied in an overlapping pattern producing a 12-inch rundown.
 3. Second Coat: After 48 hours, apply a flood coat in an overlapping pattern producing a 12-inch rundown.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07200

INSULATION

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUMMARY
- 1.3 SUBMITTALS
- 1.4 PRODUCT, DELIVERY, STORAGE AND HANDLING
- 1.5 WARNING

PART 2 PRODUCTS

- 2.1 LOW DENSITY BLANKET/BATT INSULATION
- 2.2 MISCELLANEOUS MATERIALS

PART 3 EXECUTION

- 3.1 INSTALLATION OF CONCEALED LOW DENSITY FIBERGLASS BLANKET/BATT THERMAL INSULATION

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 07200

INSULATION

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

C518	Test Method of Steady-State Thermal Transmission Properties by Means of Heat Flow Meter ("R" Value)
C665	Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
E84	Surface Burning Characteristics
E96	Test Method for Water Vapor Transmission of Materials (Perm Rating)
E136	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C

UNDERWRITERS LABORATORIES (UL)

UL1256	Fire Test of Roof Deck Construction
--------	-------------------------------------

1.2 SUMMARY

- A. Section Includes:
 - 1. Building thermal insulation.
- B. Related Sections:
 - 1. Section 09250: Gypsum Wallboard

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Product Data; FIO.

Fully describe every item proposed for use. Submit UL Data Sheets for insulation required to have a flame spread rating or used as part of a fire-rated assembly.

1.4 PRODUCT, DELIVERY, STORAGE AND HANDLING

A. Deliver insulation materials to the job in original packages with manufacturer's "R" Values and UL flame spread ratings clearly shown. Provide certification of compliance with applicable Federal Specifications.

1.5 WARNING

A. The Contractor is warned that working with fiberglass or rock wool materials may constitute a serious health hazard. The Contractor shall take all necessary precautions to ensure the safety of workers.

PART 2 PRODUCTS

2.1 LOW DENSITY BLANKET/BATT INSULATION

A. Thermal, Batt Insulation. Glass fiber thermal insulation complying with ASTM E136 in 9-1/2-inch R30.

1. Kraft-faced ASTM C665, Type II, Class C.

2.2 MISCELLANEOUS MATERIALS

- A. "Z" Furring: 1-1/2-inch, 25-gauge hot dipped galvanized "Z" furring sections: U.S. Gypsum, National Gypsum, or equal.
- B. Fasteners:
1. Staples: 1/2-inch-long, 1/2-inch-wide, made from wide flat wire.
 2. Drive-Anchors: One-piece deformed spring steel anchor. 1/4-inch-diameter and long enough to achieve 1-1/2-inch-minimum embedment in the concrete substrate. 2,000-pound minimum holding power. RAWL-Drives, Buildex, or equal.
- C. Insulation Support Wire: 16-gauge galvanized steel wire.

PART 3 EXECUTION

3.1 INSTALLATION OF CONCEALED LOW DENSITY FIBERGLASS BLANKET/BATT THERMAL INSULATION

- A. In Metal Stud Ceilings:
1. Friction fit 3-1/2-inch insulation blanket between joints.
 2. Place kraft face on the top side.
- B. Do not install insulation on top of or within 3 inches of recessed light fixtures unless the fixtures are UL approved for such use.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07220

ROOF INSULATION

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 STORAGE OF MATERIALS
- 1.4 FIRE CLASSIFICATION

PART 2 PRODUCTS

- 2.1 BITUMINOUS MATERIALS
 - 2.1.1 Asphalt Bitumen
 - 2.1.2 Asphalt Cement
 - 2.1.3 Asphalt Primer
- 2.2 INSULATION
 - 2.2.1 Cellular Glass
- 2.3 FASTENERS
- 2.4 GLASS ROOFING FELT

PART 3 EXECUTION

- 3.1 COORDINATION REQUIREMENTS
- 3.2 ENVIRONMENTAL CONDITIONS
- 3.3 SUBSTRATE PREPARATION
- 3.4 HEATING OF ASPHALT
- 3.5 VAPOR RETARDER
 - 3.5.1 General Application
 - 3.5.2 Edge Requirements
- 3.6 APPLICATION OF INSULATION
 - 3.6.1 Mechanical Fastening
 - 3.6.2 Steel Decks
 - 3.6.3 Installation
 - 3.6.4 Protection Requirements
- 3.7 INSPECTION

-- End of Section Table of Contents --

SECTION 07220

ROOF INSULATION

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A208.1 (1999) Particleboard Mat Formed Woods

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 208 (1995) Cellulosic Fiber Insulating Board

ASTM C 552 (1991) Cellular Glass Thermal Insulation

ASTM C 578 (1995) Rigid, Cellular Polystyrene Thermal Insulation

ASTM C 726 (1993) Mineral Fiber Roof Insulation Board

ASTM C 728 (1997) Perlite Thermal Insulation Board

ASTM C 1050 (1991) Rigid Cellular Polystyrene-Cellulosic Fiber Composite Roof Insulation

ASTM C 1177/C 1177M (1996) Glass Mat Gypsum Substrate for Use as Sheathing

ASTM C 1289 (1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

ASTM D 41 (1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

ASTM D 226 (1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

ASTM D 312 (1995a) Asphalt Used in Roofing

ASTM D 2178 (1997a) Asphalt Glass Felt Used in Roofing and Waterproofing

ASTM D 4586 (1993) Asphalt Roof Cement, Asbestos Free
ASTM D 4897 (1998) Asphalt-Coated Glass-Fiber Venting
Base Sheet Used in Roofing

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P9513 (1996) Loss Prevention Data for Roofing
Contractors
FM P7825a (1998) Approval Guide Fire Protection
FM P7825c (1998) Approval Guide Building Materials

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (1999) Building Materials Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Product Data; FIO.

Data to show that the material conforms to the Specification requirement.

1.3 STORAGE OF MATERIALS

Insulation materials shall be stored in accordance with manufacturer's instructions. Insulation, base sheet, and felt shall be kept dry at all times, before, during, and after delivery to the site and shall be stored in an enclosed building or in a closed trailer. Wet insulation, wet base sheet or wet felt shall be permanently removed from the site. Felts shall be stacked on end one level high. Felt rolls shall be maintained at a temperature above 50 degrees F for 24 hours immediately before laying.

1.4 FIRE CLASSIFICATION

Insulation shall have been tested as part of a roof construction assembly of the type used in this project, and the construction shall be listed as Fire-Classified in UL Bld Mat Dir or Class I in FM P7825a.

PART 2 PRODUCTS

2.1 BITUMINOUS MATERIALS

Bituminous materials shall conform to the following requirements:

2.1.1 Asphalt Bitumen

ASTM D 312, Type III or IV. Asphalt flash point, finished blowing temperature, and equiviscous temperature (EVT) for mop and for mechanical spreader application shall be indicated on bills of lading or on individual containers.

2.1.2 Asphalt Cement

ASTM D 4586, Type I for surfaces sloped from 0 to 3 inches per foot; Type II for slopes greater than 3 inches per foot.

2.1.3 Asphalt Primer

ASTM D 41.

2.2 INSULATION

Insulation shall be a standard product of the manufacturer and shall be factory marked with the manufacturer's name or trade mark, the material specification number, the R-value at 75 degrees F, and the thickness. Minimum thickness shall be as recommended by the manufacturer. Boards shall be marked individually. The thermal resistance of insulation shall be not less than the R-value shown on the drawings. The insulation manufacturing process shall not include chlorofluoro carbons (CFC) or formaldehydes. Insulation and fiberboard shall contain the highest practicable percentage of material which has been recovered or diverted from solid waste (e.g., postconsumer waste), but not including material reused in a manufacturing process. Where two materials have comparable price and performance, the one having the higher recovered material content shall be selected. Insulation shall be:

2.2.1 Cellular Glass

ASTM C 552, Type IV.

2.3 FASTENERS

Fasteners shall be specifically designed screws and plates or spikes and plates of sufficient length to hold insulation securely in place. Fasteners shall conform to insulation manufacturer's recommendations except that holding power, when driven, shall be not less than 120 pounds each in steel deck. Fasteners for steel or concrete decks shall conform to FM P7825c for Class I roof deck construction, and shall be spaced to withstand an uplift pressure of 60 pounds per square foot.

2.4 GLASS ROOFING FELT

ASTM D 2178, Type IV or VI.

PART 3 EXECUTION

3.1 COORDINATION REQUIREMENTS

Insulation and roofing membrane shall be finished in one operation up to the line of termination at the end of each day's work. Completed sections shall be glaze coated when more than one day is required to finish the roofing. Phased construction will not be permitted.

3.2 ENVIRONMENTAL CONDITIONS

The temperature of the roofing materials shall be as required by the manufacturer. Air temperature shall be above 40 degrees F and there shall be no visible ice, frost, or moisture on the roof deck when the insulation and roofing are installed. Wind conditions shall be suitable for installation of insulation: Wind chill may affect the proper application temperatures of materials; hot materials may be blown about, creating safety dangers; insulation boards may become difficult and hazardous to handle; wrappers, coverings, and other debris may become airborne, and possibly contaminate laps and seams.

3.3 SUBSTRATE PREPARATION

The substrate construction of any bay or section of the building shall be completed before insulation or vapor retarder work is begun thereon. Insulation or vapor retarder to be applied. Vents and other items penetrating the roof shall be secured in position and properly prepared for flashing. Prior to application of insulation, substrate joints shall be covered with a 4 inch strip of roofing felt, embedded in and coated with asphalt cement. Substrate surface shall be smooth, clean, and dry at time of application.

3.4 HEATING OF ASPHALT

Asphalt shall not be heated higher than 105 degrees F above the EVT or 50 degrees F below the flash point, or 525 degrees F, whichever is lower. EVT and flash point temperatures of asphalt in the kettle shall be conspicuously posted on the kettle. Kettle shall be provided with automatic thermostatic controls and an accurate thermometer. Kettle operators shall be in attendance at all times during heating to ensure that the maximum temperature is not exceeded. Asphalt shall be applied within a range of 25 degrees F below or above the EVT, or as specified by the manufacturer. Application temperature shall be measured at the mop bucket or mechanical applicator. Asphalt at a temperature below this range shall be returned to the kettle. Flame-heated equipment shall not be placed on the roof.

3.5 VAPOR RETARDER

3.5.1 General Application

Vapor retarder shall consist of two plies of roofing felt, mopped at right angle to the slope, with 6 inch end laps staggered at least 12 inches. The full 19 inch starter ply and full 36 inch wide ply sheets shall be placed, in succession, in hot asphalt immediately behind the applicator. Each ply shall be solid mopped in not less than 20 pound nor more than 30 pounds of asphalt per square. A follow tool shall be used with glass felts and a broom shall be used with organic felts to embed the felts, eliminate air

pockets and obtain adhesion between the plies. Side and end laps shall be completely sealed. Asphalt shall be visible beyond all edges of each ply as it is being installed. Plies shall be laid free of wrinkles, creases or fishmouths. Workers shall not walk on mopped surfaces when the asphalt is sticky. For slopes exceeding 1/2 inch per foot, some manufacturers allow or require that the felts be run parallel to the slope and that they be nailed off into strategically installed nailers which are perpendicular to the slope; each ply shall be nailed 2 and 6 inches from the upper edge with nails spaced 12 inches on centers and staggered in each row.

3.5.2 Edge Requirements

At walls, eaves and rakes, the vapor retarder organic felts shall be extended 9 inches, or separate organic felt plies shall be extended 9 inches, with not less than 9 inches on the substrate, and the extended portion turned back and mopped in over the top of the insulation. At roof penetrations other than walls, eaves and rakes, the vapor retarder or separate plies shall be extended 9 inches to form a lap which shall later be folded back over the edge of the insulation. Asphalt roof cement shall be used under the vapor retarder for at least 9 inches from walls, eaves, rakes and other penetrations.

3.6 APPLICATION OF INSULATION

3.6.1 Mechanical Fastening

Insulation shall be mechanically fastened. Method of attachment shall be in accordance with recommendations of the insulation manufacturer and requirements specified.

3.6.2 Steel Decks

All steel decks shall be insulated before receiving a roof membrane. Uninsulated steel decks shall have insulation applied to span the steel deck flutes and to act as an underlayment for the roof membrane. First layer of insulation on steel deck shall be compatible with mechanical fastening and shall meet fire resistant requirements.

3.6.3 Installation

Except for the first layer on steel deck, insulation layers shall be laid in solid moppings of hot asphalt applied (over a fastened base ply, lightweight insulating concrete, gypsum or wood) at a rate of at least 20 pounds per square. Asphalt shall not be applied further than one panel length ahead of roof insulation being installed. Where roof slopes are greater than 1/2 inch/foot, roof insulation shall be held in place by both asphalt mopping and mechanical fasteners. Asphalt primer shall be applied at the rate of 1 gallon per square over the entire surface to be mopped when the insulation is applied over concrete deck. The edges of insulation boards adjoining vented nailers shall be kept free of asphalt.

3.6.4 Protection Requirements

The insulation shall be kept dry at all times. Insulation boards shall not

be kicked into position. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent. Cutoffs shall be 2 layers of bituminous-saturated felt set in plastic bituminous cement. Cutoffs shall be removed when work is resumed. Edges of insulation at open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, shall be protected until permanent roofing and flashing is applied. Storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces will not be permitted. Smooth, clean board or plank walkways, runways, and platforms shall be used, as necessary to distribute weight to conform to a 20 psf live load limit.

3.7 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.
- b. Verification of certification, listing or label compliance with FM P9513.
- c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.
- d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.
- e. Inspection of mechanical fasteners; type, number, length, and spacing.
- f. Coordination with other materials, cants, sleepers, and nailing strips.
- g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.
- h. Installation of cutoffs and proper joining of work on subsequent days.
- i. Continuation of complete roofing system installation to cover insulation installed same day.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07412

NON-STRUCTURAL METAL ROOFING

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 GENERAL REQUIREMENTS
 - 1.3.1 Non-Structural Metal Roof System
 - 1.3.2 Manufacturer
 - 1.3.3 Installer
- 1.4 DESIGN LOADS
- 1.5 PERFORMANCE REQUIREMENTS
- 1.6 DELIVERY AND STORAGE
- 1.7 WARRANTIES
 - 1.7.1 Contractor's Weathertightness Warranty
 - 1.7.2 Manufacturer's Material Warranties
- 1.8 COORDINATION MEETING

PART 2 PRODUCTS

- 2.1 ROOF PANELS
 - 2.1.1 Steel Panels
- 2.2 ACCESSORIES
- 2.3 FASTENERS
- 2.4 FACTORY COLOR FINISH
 - 2.4.1 Cyclic Salt Fog/UV Test
 - 2.4.2 Formability Test
 - 2.4.3 Accelerated Weathering, Chalking Resistance and Color Change
 - 2.4.4 Humidity Test
 - 2.4.5 Impact Resistance
 - 2.4.6 Abrasion Resistance Test
 - 2.4.7 Pollution Resistance
- 2.5 UNDERLAYMENTS
 - 2.5.1 Felt Underlayment
 - 2.5.2 Rubberized Underlayment
 - 2.5.3 Slip Sheet
- 2.6 SEALANT
- 2.7 GASKETS AND INSULATING COMPOUNDS

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Roofing

- 3.1.2 Field Forming of Roof Panels for Unique Areas
- 3.1.3 Underlayment
- 3.2 Forms

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 07412

NON-STRUCTURAL METAL ROOFING

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463/A 463M	(1999a) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 653/A 653M	(1999) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 792/A 792M	(1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C 518	(1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation
ASTM C 991	(1998) Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings
ASTM C 1177/C 1177M	(1996) Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C 1289	(1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

ASTM D 522	(1993a) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1999) Specular Gloss
ASTM D 610	(1995) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(1987; R 1994el) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 1308	(1987; R 1998) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	(1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(1997) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM D 4214	(1998) Evaluating Degree of Chalking of Exterior Paint Films
ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D 4587	(1991) Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water- Exposure Apparatus
ASTM D 5894	(1996) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials

ASTM E 96 (1995) Water Vapor Transmission of Materials

UNDERWRITERS LABORATORIES (UL)

UL 580 (1994; Rev thru Feb 1998) Tests for Uplift Resistance of Roof Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Data; FIO

Submit data to show that the materials conform to the Specification requirements.

SD-13 Certificates

Warranties; FIO

At the completion of the project, signed copies of the 5-year Warranty for Non-Structural Metal Roofing System, a sample copy of which is attached to this section, and the 20-year Manufacturer's Material Warranties.

SD-14 Samples

Roof Panels; FIO

One piece of each type and finish to be used, 9 inches long, full width.

1.3 GENERAL REQUIREMENTS

The Contractor shall furnish a commercially available roofing system which satisfies the specified design and additional requirements contained herein. The roofing system shall be provided by the Contractor as a complete system, as tested and approved in accordance with UL 580. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same roofing system manufacturer.

1.3.1 Non-Structural Metal Roof System

The Non-Structural Metal Roof System covered under this specification shall include the entire roofing system; the metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with UL 580. The system shall be installed on a substrate specified in Section 07220. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes

roof penetration items such as vents, curbs, skylights; interior or exterior gutters and downspouts, eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of the specifications that are part of the system.

1.3.2 Manufacturer

The non-structural metal roofing system shall be the product of a manufacturer who has been in the practice of manufacturing metal roofs for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

1.3.3 Installer

The installer shall be certified by the metal roof manufacturer to have experience in installing at least three projects that are of comparable size, scope and complexity as this project for the particular roof system furnished. The installer may be either employed by the manufacturer or be an independent installer.

1.4 DESIGN LOADS

Non-structural Metal Roof System assemblies shall be tested as defined in UL 580 and shall be capable of resisting the wind uplift pressures 21 PSF shown on the contract drawings.

1.5 PERFORMANCE REQUIREMENTS

The metal roofing system supplied shall conform to the roof slope, the underlayment, and uplift pressures shown on the contract drawings. The Contractor shall furnish a commercially available roofing system which satisfies all the specified requirements.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weather tight coverings and kept dry. Material shall not be covered with plastic where such covering will allow sweating and condensation. Plastic may be used as tenting with air circulation allowed. Storage conditions shall provide good air circulation and protection from surface staining.

1.7 WARRANTIES

The Non-Structural Metal Roofing System shall be warranted as outlined below. Any emergency temporary repairs conducted by the Government shall not negate the warranties.

1.7.1 Contractor's Weathertightness Warranty

The Non-Structural Metal Roofing System shall be warranted by the Contractor on a no penal sum basis for a period of five years against

material and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The roofing covered under this warranty shall include the entire roofing system, including but not limited to, the roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with UL 580. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, skylights; interior or exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of the specifications that are part of the roof system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to service design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's required warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR NON-STRUCTURAL METAL ROOF SYSTEM, and shall start upon final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the Government covering the Contractor's warranty responsibilities effective throughout the 5 year Contractor's warranty period for the entire roofing system as outlined above.

1.7.2 Manufacturer's Material Warranties

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all Non-Structural Metal Roofing System components such as roof panels, flashing, accessories, and trim, fabricated from coil material:

a. A manufacturer's 20 year material warranty warranting that the aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, fail structurally, or perforate under normal atmospheric conditions at the site.

Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.

b. A manufacturer's 20 year exterior material finish warranty warranting that the factory color finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of 8 when measured in accordance with ASTM D 4214; or fade or change colors in excess of 5 NBS units as measured in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing or replacing the defective coated coil material.

1.8 COORDINATION MEETING

A coordination meeting shall be held within 45 days after contract award for mutual understanding of the metal roofing system contract requirements.

This meeting shall take place at the building site and shall include representatives from the Contractor, the roofing system manufacturer, the roofing supplier, the erector, the designer, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

PART 2 PRODUCTS

2.1 ROOF PANELS

Panels shall be steel and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 30 feet. Sheets longer than 30 feet may be furnished if approved by the Contracting Officer. Width of sheets shall provide nominal 12 inches of coverage in place. Design provisions shall be made for thermal expansion and contraction consistent with the type of system to be used. All sheets shall be either square-cut or miter-cut. The ridge cap shall be installed as recommended by the metal roofing manufacturer. Height of corrugations, ribs, or seams, at overlap of adjacent roof sheets shall be the building manufacturer's standard for the indicated roof slope.

Provide concealed fastener panel from the following or equal: 1) BHP Steel Building Products; 2) AEP - Span; 3) Berridge Manufacturing Co.

2.1.1 Steel Panels

Zinc-coated steel conforming to ASTM A 653/A 653M; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 50 coating; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2 65. Uncoated roof panels shall be 0.024 inch thick minimum. Panels shall be within 95 percent of the nominal thickness.

2.2 ACCESSORIES

Accessories shall be compatible with the roofing furnished. Flashing, trim, metal closure strips, caps, and similar metal accessories shall be not less than the minimum thicknesses specified for roof panels. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water.

2.3 FASTENERS

Fasteners for roof panels shall be zinc-coated steel, or nylon capped steel, type and size as recommended by the manufacturer to meet the performance requirements. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be gasketed or have

gasketed washers on the exterior side of the roofing to waterproof the fastener penetration. Washer material shall be compatible with the panels; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8 inch thick.

2.4 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated in Section 09915 COLOR SCHEDULE. The exterior coating shall be a nominal 1 mil thickness consisting of a topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 0.2 mil thickness. The exterior color finish shall meet the test requirements specified below.

2.4.1 Cyclic Salt Fog/UV Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610; and a rating of 6, over 1/16 to 1/8 inch failure at scribe, as determined by ASTM D 1654.

2.4.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 1/8 inch diameter mandrel, the coating film shall show no evidence of fracturing to the naked eye.

2.4.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM D 4587, test condition for 12 total hours. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244.

2.4.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.4.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in

accordance with ASTM D 2794 0.500 inch diameter hemispherical head indenter, equal to 1.5 times the metal thickness in mils, expressed in inch-pounds, with no cracking.

2.4.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.4.7 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.5 UNDERLAYMENTS

2.5.1 Felt Underlayment

Felt underlayment shall be No. 30 felt in accordance with ASTM D 226, Type II.

2.5.2 Rubberized Underlayment

Rubberized underlayment shall be equal to "Ice and Water Shield" as manufactured by Grace Construction Products, "Winterguard" as manufactured by CertainTeed Corporation, or "Weather Watch Ice and Water Barrier" as manufactured by GAF Building Materials Corporation.

2.5.3 Slip Sheet

Slip Sheet shall be 5 pounds per 100 sf rosin sized unsaturated building paper.

2.6 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

2.7 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

3.1.1 Roofing

Side laps shall be laid away from the prevailing winds. Side and end lap distances, joint sealing, and fastening and spacing of fasteners shall be in accordance with manufacturer's standard practice. Spacing of exposed fasteners shall present an orderly appearance. Side laps and end laps of roof panels and joints at accessories shall be sealed. Fasteners shall be driven normal to the surface. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weathertight installation. Accessories shall be fastened into substrate, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction.

3.1.2 Field Forming of Roof Panels for Unique Areas

When roofing panels are formed from factory-color-finished steel coils at the project site, the same care and quality control measures that are taken in shop forming of roofing panels shall be observed. Rollformer shall be operated by the metal roofing manufacturer's approved installer. In cold weather conditions, preheating of the steel coils to be field formed shall be performed as necessary just prior to the rolling operations.

3.1.3 Underlayment

Underlayment types shall be installed where shown on the drawings; they shall be installed directly over the substrate. If a roof panel rests directly on the underlayments, a slip sheet shall be installed as a top layer, beneath the metal roofing panels, to prevent adhesion. All underlayments shall be installed so that successive strips overlap the next lower strip in shingle fashion. Underlayments shall be installed in accordance with the manufacturer's written instructions. The underlayments shall ensure that any water that penetrates below the metal roofing panels will drain outside of the building envelope.

3.2 Forms

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM

FACILITY DESCRIPTION_____

BUILDING NUMBER:_____

CORPS OF ENGINEERS CONTRACT NUMBER:_____

CONTRACTOR

CONTRACTOR:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

OWNER

OWNER:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

CONSTRUCTION AGENT

CONSTRUCTION AGENT:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM
(continued)

THE NON-STRUCTURAL METAL ROOF SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE NON-STRUCTURAL METAL ROOFING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH UL 580. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE NON-STRUCTURAL METAL ROOFING SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE NON-STRUCTURAL METAL ROOF SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

(Company President)

(Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOFING SYSTEM
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE NON-STRUCTURAL METAL ROOFING SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE NON-STRUCTURAL METAL ROOF DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE NON-STRUCTURAL METAL ROOFING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

**

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM
(continued)

**REPORTS OF LEAKS AND ROOF SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS ROOF SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE NON-STRUCTURAL METAL ROOF SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07600

SHEET METALWORK, GENERAL

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS
- 1.4 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Accessories
 - 2.1.2 Aluminum Extrusions
 - 2.1.3 Bituminous Cement
 - 2.1.4 Sealant
 - 2.1.5 Fasteners
 - 2.1.6 Felt
 - 2.1.7 Polyvinyl Chloride (PVC) Reglets
 - 2.1.8 Aluminum Alloy Sheet and Plate
 - 2.1.9 Stainless Steel
 - 2.1.10 Solder

PART 3 EXECUTION

- 3.1 GENERAL REQUIREMENTS
- 3.2 EXPANSION JOINTS
- 3.3 PROTECTION OF ALUMINUM
 - 3.3.1 Paint
 - 3.3.2 Nonabsorptive Tape or Gasket
- 3.4 CONNECTIONS AND JOINTING
 - 3.4.1 Soldering
 - 3.4.2 Riveting
 - 3.4.3 Seaming
- 3.5 CLEATS
- 3.6 GUTTERS AND DOWNSPOUTS
- 3.7 FLASHINGS
 - 3.7.1 Base Flashing
 - 3.7.2 Counter Flashings
- 3.8 INSTALLATION OF LOUVERS
- 3.9 REGLETS
- 3.10 CONTRACTOR QUALITY CONTROL

-- End of Section Table of Contents --

SECTION 07600

SHEET METALWORK, GENERAL
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B 32	(1996) Solder Metal
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 543	(1995) Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 822	(1996) Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus
ASTM D 828	(1997) Tensile Properties of Paper and

Paperboard Using
Constant-Rate-of-Elongation-Apparatus

ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2822	(1991; R 1997el) Asphalt Roof Cement
ASTM D 3656	(1997) Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
ASTM D 4586	(1993) Asphalt Roof Cement, Asbestos Free
ASTM E 96	(1995) Water Vapor Transmission of Materials

INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

ISWA IWS 089	(1990) Recommended Standards and Specifications for Insect Wire Screening (Wire Fabric)
--------------	---

SHEET METAL & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION
(SMACNA)

SMACNA Arch. Manual	(1993; Errata; Addenda Oct 1997) Architectural Sheet Metal Manual
---------------------	--

1.2 GENERAL REQUIREMENTS

Sheet metalwork shall be accomplished to form weathertight construction without waves, warps, buckles, fastening stresses or distortion, and shall allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations. Sheet metalwork pertaining to heating, ventilating, and air conditioning is specified in Section 15895.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Materials; FIO.

Drawings of sheet metal items showing weights, gauges or thicknesses; types of materials; expansion-joint spacing; fabrication details; and

installation procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Lead, lead-coated metal, and galvanized steel shall not be used. Any metal listed by SMACNA Arch. Manual for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in SMACNA Arch. Manual. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

2.1.1 Accessories

Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided.

2.1.2 Aluminum Extrusions

ASTM B 221, Alloy 6063, Temper T5.

2.1.3 Bituminous Cement

Type I asphalt cement conforming to ASTM D 2822 or ASTM D 4586. For coal tar roofing; coal tar cement conforming to ASTM D 4022.

2.1.4 Sealant

Unless otherwise specified, sealant shall be an elastomeric weather resistant sealant as specified in Section 07900 JOINT SEALING.

2.1.5 Fasteners

Fasteners shall be compatible with the fastened material and shall be the type best suited for the application.

2.1.6 Felt

ASTM D 226, Type I.

2.1.7 Polyvinyl Chloride (PVC) Reglets

ASTM D 1784, Class 14333D, 0.075 inch minimum thickness.

2.1.8 Aluminum Alloy Sheet and Plate

ASTM B 209, anodized, clad, form, alloy, and temper appropriate for use.

2.1.9 Stainless Steel

ASTM A 167, Type 302 or 304; fully annealed, dead soft temper.

2.1.10 Solder

ASTM B 32, 95-5 tin-antimony.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Gutters and downspouts shall be designed and fabricated in conformance with SMACNA Arch. Manual; louvers shall be fabricated in conformance with SMACNA Arch. Manual and as indicated. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 1/2 inch hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing.

3.2 EXPANSION JOINTS

Expansion joints shall be provided as specified in SMACNA Arch. Manual. Expansion joints in continuous sheet metal shall be provided at 40 foot intervals for copper and stainless steel and at 32 foot intervals for aluminum, except extruded aluminum gravel stops and fasciae which shall have expansion joints at not more than 12 foot spacing. Joints shall be evenly spaced. An additional joint shall be provided where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing.

3.3 PROTECTION OF ALUMINUM

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods:

3.3.1 Paint

Aluminum surfaces shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint as specified in Section 09900 PAINTING, GENERAL.

3.3.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces

and cemented to the aluminum surface using a cement compatible with aluminum.

3.4 CONNECTIONS AND JOINTING

3.4.1 Soldering

Soldering shall apply to stainless steel items. Edges of sheet metal shall be pretinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

3.4.2 Riveting

Joints in aluminum sheets 0.040 inch or less in thickness shall be mechanically made.

3.4.3 Seaming

Flat-lock and soldered-lap seams shall finish not less than 1 inch wide. Unsoldered plain-lap seams shall lap not less than 3 inches unless otherwise specified. Flat seams shall be made in the direction of the flow.

3.5 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints of cleats shall be spaced approximately 1/8 inch apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 12 inches on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry.

3.6 GUTTERS AND DOWNSPOUTS

Gutters and downspouts shall be installed as indicated. Gutters shall be supported by cleats spaced not less than 36 inches apart. Downspouts shall be rigidly attached to the building. Supports for downspouts shall be spaced according to manufacturer's recommendations.

3.7 FLASHINGS

Flashings shall be installed at locations indicated and as specified below.

Sealing shall be according to the flashing manufacturer's recommendations.

Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof, and floor drains, and for electrical conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be

covered up by an application of bituminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement. Flashing shall be formed to direct water to the outside of the system.

3.7.1 Base Flashing

Metal base flashing shall be coordinated with roofing work. Metal base flashing shall be set in plastic bituminous cement over the roofing membrane, nailed to nailing strip, and secured in place on the roof side with nails spaced not more than 3 inches on centers. Metal base flashing shall not be used on built-up roofing.

3.7.2 Counter Flashings

Except as otherwise indicated, counter flashings shall be provided over base flashings. Counter flashing shall be installed as shown on the drawings and in accordance with the SMACNA Arch. Manual. Where bituminous base flashings are provided, the counter flashing shall extend down as close as practicable to the top of the cant strip. Counter flashing shall be factory formed to provide spring action against the base flashing.

3.8 INSTALLATION OF LOUVERS

Louvers shall be rigidly attached to the supporting construction and in accordance with Section 10200. The installation shall be rain-tight. Louver screen shall be installed as indicated.

3.9 REGLETS

Reglets shall be a factory fabricated product of proven design, complete with fittings and special shapes as required. Open-type reglets shall be filled with fiberboard or other suitable separator to prevent crushing of the slot during installation. Reglet plugs shall be spaced not over 12 inches on centers and reglet grooves shall be filled with sealant. Friction or slot-type reglets shall have metal flashings inserted the full depth of slot and shall be lightly punched every 12 inches to crimp the reglet and counter flashing together. Polyvinyl chloride reglets shall be sealed with the manufacturer's recommended sealant.

3.10 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- b. Verification of compliance of materials before, during, and after installation.
- c. Inspection of sheet metalwork for proper size and thickness, fastening and joining, and proper installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer at the end of each day.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07900

JOINT SEALING

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 ENVIRONMENTAL REQUIREMENTS
- 1.4 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 BACKING
 - 2.1.1 Rubber
 - 2.1.2 Synthetic Rubber
 - 2.1.3 Neoprene
- 2.2 BOND-BREAKER
- 2.3 PRIMER
- 2.4 SEALANT
 - 2.4.1 LATEX
 - 2.4.2 ELASTOMERIC
 - 2.4.3 PREFORMED
 - 2.4.3.1 Tape
- 2.5 SOLVENTS AND CLEANING AGENTS

PART 3 EXECUTION

- 3.1 GENERAL
 - 3.1.1 Surface Preparation
 - 3.1.2 Concrete and Masonry Surfaces
 - 3.1.3 Steel Surfaces
 - 3.1.4 Aluminum Surfaces
 - 3.1.5 Wood Surfaces
- 3.2 APPLICATION
 - 3.2.1 Masking Tape
 - 3.2.2 Backing
 - 3.2.3 Bond-Breaker
 - 3.2.4 Primer
 - 3.2.5 Sealant
- 3.3 CLEANING

-- End of Section Table of Contents --

SECTION 07900

JOINT SEALING

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509	(1994) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 570	(1995) Oil- and Resin-Base Caulking Compound for Building Construction
ASTM C 734	(1993) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C 834	(1995) Latex Sealants
ASTM C 920	(1998) Elastomeric Joint Sealants
ASTM C 1085	(1991) Butyl Rubber-Based Solvent-Release Sealants
ASTM C 1184	(1995el) Structural Silicone-Sealants
ASTM D 217	(1997) Cone Penetration of Lubricating Grease (IP50/88)
ASTM D 1056	(1998) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1565	(1999) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam)
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The

following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Backing; FIO. Bond-Breaker; FIO.

Sealant; FIO.

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

SD-13 Certificates

Sealant; FIO.

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 40 to 90 degrees F when the sealants are applied.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The container label or accompanying data sheet shall include the following information as applicable: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time at the standard conditions for laboratory tests. Materials shall be handled and stored to prevent inclusion of foreign materials. Materials shall be stored at temperatures between 40 and 90 degrees F unless otherwise specified by the manufacturer.

PART 2 PRODUCTS

2.1 BACKING

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

2.1.1 Rubber

Cellular rubber sponge backing shall be ASTM D 1056, Type 2, closed cell, Class A, round cross section.

2.1.2 Synthetic Rubber

Synthetic rubber backing shall be ASTM C 509, Option I, Type I preformed rods or tubes.

2.1.3 Neoprene

Neoprene backing shall be ASTM D 1056, closed cell expanded neoprene cord Type 2, Class C, Grade 2C2 .

2.2 BOND-BREAKER

Bond-breaker shall be as recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.3 PRIMER

Primer shall be non-staining type as recommended by sealant manufacturer for the application.

2.4 SEALANT

2.4.1 LATEX

Latex Sealant shall be ASTM C 834.

2.4.2 ELASTOMERIC

Elastomeric sealants shall conform to ASTM C 920 and the following:

- a. Polyurethane sealant: Grade NS , Class 12.5, Use T M A O.
- b. Silicone sealant: Type S , Grade NS , Class 25 , Use NT, G A O.

2.4.3 PREFORMED

Preformed sealant shall be polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealant capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 30 to plus 160 degrees F, the sealant shall be non-bleeding and shall have no loss of adhesion.

2.4.3.1 Tape

Tape sealant: cross-section dimensions shall be 1/4 inch by 1/4 inch.

2.5 SOLVENTS AND CLEANING AGENTS

Solvents, cleaning agents, and accessory materials shall be provided as recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Surface Preparation

The surfaces of joints to receive sealant or caulk shall be free of all

frost, condensation and moisture. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant.

Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

3.1.4 Aluminum Surfaces

Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

3.1.5 Wood Surfaces

Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

3.2 APPLICATION

3.2.1 Masking Tape

Masking tape shall be placed on the finish surface both sides of porous (such as concrete or masonry) joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

3.2.2 Backing

Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

3.2.3 Bond-Breaker

Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

3.2.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

3.2.5 Sealant

Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Joints shall be sealed as detailed in the drawings. Sealant shall be forced into joints with sufficient pressure to expel air and fill the groove solidly. Sealant shall be installed to the indicated depth without displacing the backing. Unless otherwise indicated, specified, or recommended by the manufacturer, the installed sealant shall be dry tooled to produce a uniformly smooth surface free of wrinkles and to ensure full adhesion to the sides of the joint; the use of solvents, soapy water, etc., will not be allowed. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

3.3 CLEANING

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

-- End of Section --

WATER TREATMENT PLANT

Beale AFB, California

**IFB NO.
SPECIFICATION NO.
DRAWING FILE NO.**

**DACA05-01-B-0001
1136
131-25-1307**



**US Army Corps
of Engineers
Sacramento District**

**DIRECTIVE NO. 1 Dated 05 Jun 99
PROJECT NO. 961005 R1**

PROJECT TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

01320 PROJECT SCHEDULE
01330 SUBMITTAL PROCEDURES
01355 ENVIRONMENT PROTECTION
01451 CONTRACTOR QUALITY CONTROL
01500 TEMPORARY CONSTRUCTION FACILITIES
01505 GENERAL REQUIREMENTS
01510 WORK SEQUENCE AND GOVERNMENT FURNISHED ITEMS
01600 MATERIAL AND EQUIPMENT (BEALE AFB)
01700 CONTRACT CLOSEOUT (BEALE AFB)

DIVISION 02 - SITE WORK

02220 DEMOLITION
02230 CLEARING AND GRUBBING
02300 EARTHWORK
02510 WATER SYSTEM PIPING AND ACCESSORIES
02531 SANITARY SEWERS
02630 STORM-DRAINAGE SYSTEM
02705 PAVING AND RESURFACING
02821 FENCING
02930 EXTERIOR PLANTING
02950 IRRIGATION SYSTEM

DIVISION 03 - CONCRETE

03100 STRUCTURAL CONCRETE FORMWORK
03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS
03200 CONCRETE REINFORCEMENT
03300 CAST-IN-PLACE STRUCTURAL CONCRETE

DIVISION 04 - MASONRY

04200 MASONRY

DIVISION 05 - METALS

05120 STRUCTURAL STEEL
05500 MISCELLANEOUS METAL

DIVISION 06 - WOODS & PLASTICS

06610 FIBERGLASS REINFORCED PANELS

DIVISION 07 - THERMAL & MOISTURE PROTECTION

07190 WATER REPELLENT SEALER
07200 INSULATION
07220 ROOF INSULATION
07412 NON-STRUCTURAL METAL ROOFING
07600 SHEET METALWORK, GENERAL
07900 JOINT SEALING

DIVISION 08 - DOORS & WINDOWS

08110 STEEL DOORS AND FRAMES

08330 OVERHEAD ROLLING DOORS
08520 ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS
08700 BUILDERS' HARDWARE

DIVISION 09 - FINISHES

09250 GYPSUM WALLBOARD
09650 RESILIENT FLOORING
09900 PAINTING, GENERAL
09915 COLOR SCHEDULE
09960 PROTECTIVE COATINGS

DIVISION 10 - SPECIALTIES

10050 BUILDING SPECIALTIES
10200 LOUVERS
10400 IDENTIFYING DEVICES
10800 TOILET ACCESSORIES

DIVISION 11 - EQUIPMENT

11001 GENERAL EQUIPMENT AND MECHANICAL REQUIREMENTS
11003 DISINFECTION
11215 VERTICAL TURBINE PUMPS
11350 AERATOR
11353 BRINE MAKE-UP SYSTEM
11354 CHLORINE FEED SYSTEM
11355 FLUORIDE FEED SYSTEM
11357 PRESSURE FILTERS

DIVISION 12 - FURNISHINGS

12320 CABINETS AND COUNTERTOPS

DIVISION 13 - SPECIAL CONSTRUCTION

13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT
13202 ABOVEGROUND FUEL TANK
13211 WELDED STEEL TANK
13405 PROCESS CONTROLS
13410 CONTROL STRATEGIES
13416 CHEMICAL STORAGE TANK
13721 SMALL INTRUSION DETECTION SYSTEM
13820 MULTI-BUILDING EXPANSION OF ENERGY MONITORING AND CONTROL SYSTEMS
13850 FIRE DETECTION AND ALARM SYSTEM, DIRECT CURRENT LOOP

DIVISION 15 - MECHANICAL

15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT
15200 PIPELINES, LIQUID PROCESS PIPING
15400 PLUMBING
15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

DIVISION 16 - ELECTRICAL

16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT
16120 INSULATED WIRE AND CABLE
16261 VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS
16264 DIESEL-GENERATOR SET, STATIONARY 15-300 KW, STANDBY APPLICATIONS

16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL
16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND
16403 MOTOR CONTROL CENTERS, SWITCHBOARDS AND PANELBOARDS
16410 AUTOMATIC TRANSFER SWITCH
16415 ELECTRICAL WORK, INTERIOR
16528 EXTERIOR LIGHTING INCLUDING SECURITY
16710 PREMISES DISTRIBUTION SYSTEM
16711 TELEPHONE SYSTEM, OUTSIDE PLANT

-- End of Project Table of Contents -

SECTION TABLE OF CONTENTS

DIVISION 08 - DOORS & WINDOWS

SECTION 08110

STEEL DOORS AND FRAMES

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY AND STORAGE
- 1.4 WARRANTY

PART 2 PRODUCTS

- 2.1 DOORS AND FRAMES
- 2.2 WEATHERSTRIPPING
- 2.3 LOUVERS
- 2.4 GLAZING
- 2.5 FACTORY FINISH

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 FIELD PAINTED FINISH

-- End of Section Table of Contents --

SECTION 08110

STEEL DOORS AND FRAMES

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A250.8 (1998) Steel Doors and Frames

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283 (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

DOOR AND HARDWARE INSTITUTE (DHI)

DHI A115.1G (1994) Installation Guide for Doors and Hardware

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA 862 (1987) Hollow Metal Manual; Section: Guide Specifications for Commercial Security Hollow Metal Doors and Frames

NAAMM HMMA 865 (1995) Hollow Metal Manual; Section: Guide Specifications for Swinging Sound Control Hollow Metal Doors and Frames

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1999) Fire Doors and Fire Windows

NFPA 80A (1996) Protection of Buildings from Exterior Fire Exposures

NFPA 101 (1997; Errata 97-1; TIA-97.1) Life Safety Code

NFPA 252 (1995) Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDOI)

SDOI SDI-106	(1996) Standard Door Type Nomenclature
SDOI SDI-107	(1997) Hardware on Steel Doors (Reinforcement - Application)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Steel Doors and Frames; FIO.

Catalog cuts or descriptive data for the doors, frames, and weatherstripping including air infiltration data and manufacturers printed instructions.

1.3 DELIVERY AND STORAGE

During shipment, welded unit type frames shall be strapped together in pairs with heads at opposite ends or shall be provided with temporary steel spreaders at the bottom of each frame; and knockdown type frames shall be securely strapped in bundles. Materials shall be delivered to the site in undamaged condition, and stored out of contact with the ground and under a weathertight covering permitting air circulation. Doors and assembled frames shall be stored in an upright position in accordance with DHI A115.1G.

Abraded, scarred, or rusty areas shall be cleaned and touched up with matching finishes.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Doors and frames shall be factory fabricated in accordance with ANSI A250.8 and the additional requirements specified herein. Door grade shall be extra heavy duty (Grade III) unless otherwise indicated on the door and door frame schedules. Doors and frames shall be designation G60 galvanized. Doors and frames shall be prepared to receive hardware conforming to the templates and information provided under Section 08700 BUILDERS' HARDWARE. Doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts as required. Doors and frames shall be reinforced for surface applied hardware. Frames shall be welded type located as shown. Door frames shall be furnished with a

minimum of three jamb anchors and one floor anchor per jamb. Anchors shall be not less than 18 gauge steel or 7 gauge diameter wire. For wall conditions that do not allow the use of a floor anchor, an additional jamb anchor shall be provided. Rubber silencers shall be furnished for installation into factory predrilled holes in door frames; adhesively applied silencers are not acceptable. Where frames are installed in plaster or masonry walls, plaster guards shall be provided on door frames at hinges and strikes. Reinforcing of door assemblies for closers and other required hardware shall be in accordance with ANSI A250.8 and the conditions of the fire door assembly listing when applicable. Exterior doors shall have top edges closed flush and sealed against water penetration.

2.2 WEATHERSTRIPPING

Unless otherwise specified in Section 08700 BUILDERS' HARDWARE, weatherstripping shall be as follows: Weatherstripping for head and jamb shall be manufacturer's standard elastomeric type of synthetic rubber, vinyl, or neoprene and shall be installed at the factory or on the jobsite in accordance with the door frame manufacturer's recommendations. Weatherstripping for bottom of doors shall be as shown. Air leakage rate of weatherstripping shall not exceed 0.20 cfm per linear foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.3 LOUVERS

Where indicated, doors shall be provided with louver sections. Louvers shall be sightproof type inserted into the door. Inserted louvers shall be stationary. Louvers shall be nonremovable from the outside of exterior doors or the unsecure side of interior doors. Insect screens shall be a removable type with 18 by 16 mesh aluminum or bronze cloth. Full louver doors shall be in accordance with ANSI A250.8, Grade III, Model 3.

2.4 GLAZING

Glazing shall be as specified in Section 08810 GLASS AND GLAZING. Removable glazing beads shall be screw-on or snap-on type.

2.5 FACTORY FINISH

Doors and frames shall be phosphatized and primed with standard factory primer system. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with DHI A115.1G. Preparation for surface applied hardware shall be in accordance with SDOI SDI-107. Rubber silencers shall be installed in door frames after finish painting has been completed; adhesively applied silencers are not acceptable. Weatherstripping shall be installed at exterior door openings to provide a weathertight installation. Hollow metal door frames shall be solid grouted

in masonry walls.

3.2 FIELD PAINTED FINISH

Steel doors and frames shall be field painted in accordance with Section 09900 PAINTING, GENERAL. Weatherstrips shall be protected from paint. Finish shall be free of scratches or other blemishes. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 08 - DOORS & WINDOWS

SECTION 08330

OVERHEAD ROLLING DOORS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DESCRIPTION
 - 1.2.1 Wind Load Requirements
 - 1.2.2 Operational Cycle Life
- 1.3 SUBMITTALS
- 1.4 DELIVERY AND STORAGE
- 1.5 WARRANTY
- 1.6 OPERATION AND MAINTENANCE MANUALS

PART 2 PRODUCTS

- 2.1 OVERHEAD ROLLING DOORS
 - 2.1.1 Curtains
 - 2.1.1.1 Slats
 - 2.1.2 Endlocks and Windlocks
 - 2.1.3 Bottom Bar
 - 2.1.4 Guides
 - 2.1.5 Barrel
 - 2.1.6 Springs
 - 2.1.7 Brackets
 - 2.1.8 Hoods
 - 2.1.9 Weatherstripping
 - 2.1.10 Slat Openings
 - 2.1.11 Operation
 - 2.1.11.1 Manual Hand-Chain Operation
 - 2.1.12 Inertia Brake
 - 2.1.13 Locking
 - 2.1.14 Finish

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 FIELD PAINTED FINISH

-- End of Section Table of Contents --

SECTION 08330

OVERHEAD ROLLING DOORS

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653/A 653M	(1999a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM E 330	(1997e1) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

ASHRAE HDBK-IP	(1997) Handbook, Fundamentals I-P Edition
ASHRAE HDBK-SI	(1997) Handbook, Fundamentals SI Edition

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC
NEMA ICS 6	(1993) Industrial Control and Systems Enclosures
NEMA MG 1	(1998) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
---------	---------------------------------

NFPA 80

(1999) Fire Doors and Fire Windows

1.2 DESCRIPTION

Overhead rolling doors shall be spring counterbalanced, rolling type, with interlocking slats, complete with guides, fastenings, hood, brackets, and operating mechanisms, and shall be designed for use on openings as indicated. Each door shall be provided with a permanent label showing the manufacturer's name and address and the model/serial number of the door.

1.2.1 Wind Load Requirements

Doors and components shall be designed to withstand the minimum design wind load of 20 psf. Doors shall be constructed to sustain a superimposed load, both inward and outward, equal to 1-1/2 times the minimum design wind load. Test data showing compliance with design windload requirements for the specific door design tested in accordance with the uniform static air pressure difference test procedures of ASTM E 330 shall be provided. Recovery shall be at least 3/4 of the maximum deflection within 24 hours after the test load is removed. Sound engineering principles may be used to interpolate or extrapolate test results to door sizes not specifically tested

1.2.2 Operational Cycle Life

All portions of the door and door operating mechanism that are subject to movement, wear, or stress fatigue shall be designed to operate through a minimum number of 10 cycles per day. One complete cycle of door operation is defined as when the door is in the closed position, moves to the full open position, and returns to the closed position.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Overhead Rolling Door Unit; FIO.

Manufacturer's catalog data, test data, and summary of forces and loads on the walls/jambs.

SD-04 Drawings

Overhead Rolling Door Unit; FIO.

Drawings showing the location of each door including schedules. Drawings shall include elevations of each door type, details and method of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, details of joints and connections, and details of guides, and other fittings.

SD-06 Instructions

Overhead Rolling Door Unit; FIO.

Manufacturer's preprinted installation instructions.

SD-19 Operation and Maintenance Manuals

Operation Manual; FIO.

Maintenance and Repair Manual; FIO.

System operation manual and system maintenance and repair manual for each type of door and control system.

1.4 DELIVERY AND STORAGE

Doors shall be delivered to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Doors shall be stored in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

1.6 OPERATION AND MAINTENANCE MANUALS

Operating instructions outlining the step-by-step procedures required for door and shutter operation for the overhead rolling door unit shall be provided. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified diagrams for the equipment as installed shall be provided. A complete list of parts and supplies, source of supply, and a list of the high mortality maintenance parts shall be provided.

PART 2 PRODUCTS

2.1 OVERHEAD ROLLING DOORS

Doors shall be surface-mounted type with guides at jambs set back a sufficient distance to clear the opening. Exterior doors shall be mounted as indicated.

2.1.1 Curtains

The curtains shall roll up on a barrel supported at the head of opening on brackets, and shall be balanced by helical torsion springs. Steel slats

shall be minimum bare metal thickness of 0.0281 inches. Slats shall be of the minimum bare metal decimal thickness required for the width and the wind pressure specified above.

2.1.1.1 Slats

Curtains shall be formed of interlocking slats of shapes standard with the manufacturer. Slats for exterior doors shall be flat type.

2.1.2 Endlocks and Windlocks

The ends of each alternate slat for interior doors shall have steel endlocks of manufacturer's stock design. In addition to endlocks, doors shall have the manufacturer's standard windlocks as required to withstand the wind load. Windlocks shall prevent the curtain from leaving guides because of deflection from specified wind pressure.

2.1.3 Bottom Bar

The curtain shall have a standard bottom bar consisting of two hot-dip galvanized steel angles for steel doors.

2.1.4 Guides

Guides shall be steel structural shapes or formed steel shapes, of a size and depth to provide proper clearance for operation and resistance under the design windload. Guides shall be attached to adjoining construction with fasteners recommended by the manufacturer. Spacing of fasteners shall be as required to meet the minimum design windload.

2.1.5 Barrel

The barrel shall be steel pipe or commercial welded steel tubing of proper diameter for the size of curtain. Deflection shall not exceed 0.03 inch per foot of span. Ends of the barrel shall be closed with metal plugs, machined to fit the pipe. Aluminum plugs are acceptable on non-fire door barrels.

2.1.6 Springs

Oil tempered helical steel counter-balance torsion springs shall be installed within the barrel and shall be capable of producing sufficient torque to assure easy operation of the door curtain. Access shall be provided for spring tension adjustment from outside of the bracket without removing the hood.

2.1.7 Brackets

Brackets shall be of steel plates to close the ends of the roller-shaft housing, and to provide mounting surfaces for the hood. An operation bracket hub and shaft plugs shall have sealed prelubricated ball bearings.

2.1.8 Hoods

Hoods shall be steel with minimum bare metal thickness of 0.0219 inches formed to fit contour of the end brackets, and shall be reinforced with steel rods, rolled beads, or flanges at top and bottom edges. Multiple segment and single piece hoods shall be provided with support brackets of the manufacturer's standard design as required for adequate support.

2.1.9 Weatherstripping

Exterior doors shall be fully weatherstripped. A compressible and replaceable weather seal shall be attached to the bottom bar. Weather seal at door guides shall be continuous vinyl or neoprene, bulb or leaf type, or shall be nylon-brush type. A weather baffle shall be provided at the lintel or inside the hood. Weatherstripping shall be easily replaced without special tools.

2.1.10 Slat Openings

2.1.11 Operation

Doors shall be operated by means of manual crank with provision made for future installation of electric power.

2.1.11.1 Manual Hand-Chain Operation

Operation shall be by means of a galvanized endless chain extending to within 3 feet of floor. Reduction shall be provided by use of roller chain and sprocket drive or suitable gearing, to reduce the pull required on hand chain to not over 35 lbf. Gears shall be high grade gray cast iron.

2.1.12 Inertia Brake

Overhead rolling door shall have a mechanical inertia brake device which will stop the door from free fall in any position, should there be a failure in the roller chain drive. The unit shall be capable of being reset with a back drive action.

2.1.13 Locking

Locking shall consist of chain lock keeper, suitable for padlock by others, for chain operated doors .

2.1.14 Finish

Steel slats and hoods shall be hot-dip galvanized G90 in accordance with ASTM A 653/A 653M, and shall be treated for paint adhesion and shall receive a factory baked-on finish coat . The paint system shall withstand a minimum of 1500 hours without blistering, bubbling, or rust. Surfaces other than slats, hood, and faying surfaces shall be cleaned and treated to assure maximum paint adherence and shall be given a factory dip or spray coat of rust inhibitive metallic oxide or synthetic resin primer. Color shall be in accordance with Section 09915 COLOR SCHEDULE .

PART 3 EXECUTION

3.1 INSTALLATION

Doors shall be installed in accordance with approved detail drawings and manufacturer's instructions. Anchors and inserts for guides, brackets, hardware, and other accessories shall be accurately located. Upon completion, doors shall be free from warp, twist, or distortion. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely.

3.2 FIELD PAINTED FINISH

Guides and miscellaneous unfinished exposed parts shall be field painted in accordance with Section 09900 PAINTING, GENERAL. Weatherstrips shall be protected from paint. Finish shall be free of scratches or other blemishes. Color shall match the door slats and hood.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 08 - DOORS & WINDOWS

SECTION 08520

ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 WINDOW PERFORMANCE
 - 1.2.1 Structural Performance
 - 1.2.2 Air Infiltration
 - 1.2.3 Water Penetration
 - 1.2.4 Thermal Performance
 - 1.2.5 Condensation Index Rating
 - 1.2.6 Life Safety Criteria
- 1.3 SUBMITTALS
- 1.4 QUALIFICATION
- 1.5 DELIVERY AND STORAGE
- 1.6 WARRANTY

PART 2 PRODUCTS

- 2.1 ALUMINUM WINDOW TYPES
 - 2.1.1 Horizontal-Sliding Windows
- 2.2 WEATHERSTRIPPING
- 2.3 INSECT SCREENS
- 2.4 ACCESSORIES
 - 2.4.1 Fasteners
 - 2.4.2 Hardware
 - 2.4.3 Window Anchors
- 2.5 GLASS AND GLAZING
- 2.6 GLASS
 - 2.6.1 General
 - 2.6.2 Safety Glass, Tempered
 - 2.6.3 Bronze Insulating Glass
 - 2.6.4 Glazing Materials
- 2.7 FINISH
 - 2.7.1 Anodized Aluminum Finish
 - 2.7.2 High-Performance Coating
 - 2.7.3 Color

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 ADJUSTMENTS AND CLEANING
 - 3.2.1 Hardware Adjustments

3.2.2 Cleaning

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 08520

ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101 (1997) Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors

AAMA 603 (1998) Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum

AAMA 605 (1998) voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3656 (1997) Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

ASTM E 90 (1999) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

ASTM E 283 (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM E 330 (1997e1) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

ASTM E 331 (1996) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

ASTM E 413 (1987; R 1999) Rating Sound Insulation

ASTM E 547 (1996) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential

ASME INTERNATIONAL (ASME)

ASME A39.1 (1995; A39.1a; A39.1b) Safety Requirements for Window Cleaning

INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

ISWA IWS 089 (1990) Recommended Standards and Specifications for Insect Wire Screening (Wire Fabric)

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100 (1997) Procedure for Determining Fenestration Product U-factors

NFRC 200 (1997) Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (1997; Errata 97-1; TIA-97-1) Life Safety Code

SCREEN MANUFACTURERS ASSOCIATION (SMA)

SMA ANSI/SMA 1004 (1987) Aluminum Tubular Frame Screens for Windows

1.2 WINDOW PERFORMANCE

Aluminum windows shall meet the following performance requirements. Testing requirements shall be performed by an independent testing laboratory or agency.

1.2.1 Structural Performance

Structural test pressures on window units shall be for positive load (inward) and negative load (outward) in accordance with ASTM E 330. After testing, there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There shall be no permanent

deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA 101 for the window types and classification specified in this section.

1.2.2 Air Infiltration

Air infiltration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 283.

1.2.3 Water Penetration

Water penetration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 547.

1.2.4 Thermal Performance

Window units shall comply with the U.S. Department of Energy, Energy Star Window Program for the Central Climate Zone. $0.35 \text{ Btu/hr-ft}^2\text{-F}$ determined according to NFRC 100.

1.2.5 Condensation Index Rating

The condensation index rating shall be 85 as determined using NFRC approved software THERM.

1.2.6 Life Safety Criteria

Windows shall conform to NFPA 101 Life Safety Code when rescue and/or second means of escape are indicated.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Aluminum Windows; FIO

Manufacturer's descriptive data and catalog cut sheets.

Manufacturer's preprinted installation instructions and cleaning instructions.

SD-04 Drawings

Aluminum Windows; GA

Drawings indicating elevations of window, rough-opening dimensions for each type and size of window, full-size sections, thicknesses of metal, fastenings, methods of installation and anchorage, connections with other work, type of wall construction, size and spacing of anchors, method of

glazing, types and locations of operating hardware, mullion details, weatherstripping details, and window schedules showing locations of each window type.

SD-09 Reports

Aluminum Windows; FIO

Reports for each type of aluminum window attesting that identical windows have been tested and meet all performance requirements established under paragraph WINDOW PERFORMANCE.

SD-13 Certificates

Aluminum Windows; FIO

Certificates stating that the aluminum windows are AAMA certified conforming to requirements of this section. Labels or markings permanently affixed to the window will be accepted in lieu of certificates. Product ratings determined using NFRC 100 and NFRC 200 shall be authorized for certification and properly labeled by the manufacturer.

1.4 QUALIFICATION

Window manufacturer shall specialize in designing and manufacturing the type of aluminum windows specified in this section, and shall have a minimum of three years of documented successful experience. Manufacturer shall have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.5 DELIVERY AND STORAGE

Aluminum windows shall be delivered to project site and stored in accordance with manufacturer's recommendations. Damaged windows shall be replaced with new windows.

1.6 WARRANTY

Manufacturer's standard 10 year minimum performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 ALUMINUM WINDOW TYPES

Aluminum windows shall consist of complete units including sash, glass, frame, weatherstripping, and hardware. Windows shall conform to AAMA 101. Windows shall be thermal break type double-glazed. Thermal barrier shall be neoprene, rigid vinyl, or polyurethane and shall be resistant to weather. Window members shall be heli-arc welded or angle-reinforced and mechanically joined and sealed. Exposed welded joints shall be dressed and finished. Joints shall be permanent and weathertight. Frames shall be constructed to provide a minimum 1/4 inch thermal break between the

exterior and interior frame surfaces. Sash corners shall be internally sealed to prevent air and water leaks. Inner sash shall be key-controlled to swing to the interior to allow maintenance and replacement of the glass. Not less than 2 control keys shall be furnished.

2.1.1 Horizontal-Sliding Windows

Aluminum horizontal (HS) sliding windows shall conform to AAMA 101 HS-AW40 type consisting of sliding sash and fixed lite. Sash guides shall be nylon wheels. Windows shall be provided with locking devices to secure the sash in the closed position.

2.2 WEATHERSTRIPPING

Weatherstripping for ventilating sections shall be of type designed to meet water penetration and air infiltration requirements specified in this section in accordance with AAMA 101, and shall be manufactured of material compatible with aluminum and resistant to weather. Weatherstrips shall be factory-applied and easily replaced in the field. Neoprene or polyvinylchloride weatherstripping are not acceptable where exposed to direct sunlight.

2.3 INSECT SCREENS

Insect screens shall be aluminum window manufacturer's standard design, and shall be provided where scheduled on drawings. Insect screens shall be fabricated of extruded tubular-shaped aluminum frames conforming to SMA ANSI/SMA 1004 and (18 x 16) vinyl coated glass screening conforming to ASTM D 3656.

2.4 ACCESSORIES

2.4.1 Fasteners

Fastening devices shall be window manufacturer's standard design made from aluminum, stainless steel, cadmium-plated steel, nickel/chrome-plated steel in compliance with AAMA 101. Self-tapping sheet metal screws will not be acceptable for material thicker than 1/16 inch.

2.4.2 Hardware

Hardware shall be as specified for each window type and shall be fabricated of aluminum, stainless steel, cadmium-plated steel, zinc-plated steel or nickel/chrome-plated steel in accordance with requirements established by AAMA 101.

2.4.3 Window Anchors

Anchoring devices for installing windows shall be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA 101.

2.5 GLASS AND GLAZING

Units shall be complete with glass and glazing provisions to meet AAMA 101. Glazing material shall be compatible with aluminum, and shall not require painting.

2.6 GLASS

2.6.1 General

Use glass that conforms to federal specification dd-g-451a. Glaze interior openings with safety glass. Glaze exterior openings with solar bronze insulating glass unless noted otherwise. Glaze openings in fire-rated doors with wired glass. Glaze openings in other doors with laminated safety glass. Glaze exterior openings in toilet rooms with solar bronze insulating glass that has a frosted glass inboard lite. Use solar bronze glass that has light transmittance of approximately 50%.

2.6.2 Safety Glass, Tempered

1/4-inch or thicker plate tempered to meet cpsc 16 cfr part 1201 category ii and permanently labeled.

2.6.3 Bronze Insulating Glass

A. Two pieces of 1/4-inch or thicker safety glass separated by a 1/2-inch minimum sealed air space. Both the inner and outer lights shall be fully tempered category ii.

B. Furnish insulating glass units fabricated by the glass manufacturer.

C. Seal two pieces of glass in a metal frame containing an air drying agent and having both primary and secondary seals, the latter being silicone. Fill the intervening air space with clean dry air.

D. Use select quality bronze tinted float glass for the outboard light.

E. Provide an assembly that has an average daylight transmittance of 38% and a shading coefficient of 0.56.

F. Provide igcc certified class cba insulating glass. Libby owens ford thermopane; ppg industries; or equal.

2.6.4 Glazing Materials

A. Glazing tape: polyisobutylene, butyl reinforced; Protective Treatments, Inc., #301; Hapco 616; or equal.

B. Glazing sealant: silicone, shore "s" hardness of 30 durometers; Dow Corning Silastic 732-rtv; General Electric stc-1200; or equal.

C. Glazing compound: elastic glazing compound containing no asbestos for use in bedding and face glazing aluminum, steel and primed wood sash meeting federal spec tt-p-781a type 1.

D. Setting block: neoprene, shore "a" hardness of 80 to 90 durometers.

E. Centering shims: neoprene, shore "a" hardness of 40 to 50 durometers.

2.7 FINISH

2.7.1 Anodized Aluminum Finish

Exposed surfaces of aluminum windows shall be finished with anodic coating conforming to AA DAF-45: Architectural Class I, AA-M10-C22-A44, color anodic coating, 0.7 mil or thicker. Finish shall be free of scratches and other blemishes.

2.7.2 High-Performance Coating

Exposed surfaces of aluminum windows shall be finished with a two-coat fluoropolymer coating system containing at least 70 percent by weight polyvinylidene fluoride, PVF2 resin, factory-applied, oven-baked, conforming to AAMA 605, with a primer coat of 0.20 to 0.30 mils and a color coat of minimum 1.0 mil, total dry film thickness of 1.20 to 1.3 mils. Finish shall be free of scratches and other blemishes.

2.7.3 Color

Color shall be dark bronze anodized.

PART 3 EXECUTION

3.1 INSTALLATION

Aluminum windows shall be installed in accordance with approved shop drawings and manufacturer's published instructions. Aluminum surfaces in contact with masonry, concrete, wood and dissimilar metals other than stainless steel, zinc, cadmium or small areas of white bronze, shall be protected from direct contact using protective materials recommended by AAMA 101. The completed window installation shall be watertight in accordance with Section 07900 JOINT SEALING.

3.2 ADJUSTMENTS AND CLEANING

3.2.1 Hardware Adjustments

Final operating adjustments shall be made after glazing work is complete. Operating sash or ventilators shall operate smoothly and shall be weathertight when in locked position.

3.2.2 Cleaning

Aluminum window finish and glass shall be cleaned on exterior and interior sides in accordance with window manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring window finish and glass surfaces.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 08 - DOORS & WINDOWS

SECTION 08700

BUILDERS' HARDWARE

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 PREDELIVERY CONFERENCE
- 1.4 DELIVERY, STORAGE, AND HANDLING
- 1.5 SPECIAL TOOLS
- 1.6 WARRANTY
- 1.7 OPERATION AND MAINTENANCE MANUALS

PART 2 PRODUCTS

- 2.1 GENERAL HARDWARE REQUIREMENTS
- 2.2 TEMPLATES
- 2.3 HINGES
- 2.4 LOCKS AND LATCHES
 - 2.4.1 Mortise Lock and Latchsets
 - 2.4.2 Lock Cylinders
 - 2.4.3 Lock Trim
- 2.5 EXIT DEVICES AND EXIT DEVICE ACCESSORIES
 - 2.5.1 Door Coordinator
 - 2.5.2 Flush Bolts
- 2.6 KEYING
- 2.7 DOOR CLOSING DEVICES
 - 2.7.1 Surface Type Closers
- 2.8 ARCHITECTURAL DOOR TRIM
 - 2.8.1 Door Protection Plates
 - 2.8.1.1 Kick Plates
- 2.9 AUXILIARY HARDWARE
- 2.10 MISCELLANEOUS
 - 2.10.1 Metal Thresholds
 - 2.10.2 Rain Drips
 - 2.10.3 Aluminum Housed Type Weatherseals
 - 2.10.4 Gasketing
 - 2.10.5 Door Stops
- 2.11 FASTENINGS
- 2.12 FINISHES

PART 3 EXECUTION

- 3.1 APPLICATION

- 3.1.1 Door-Closing Devices
 - 3.1.2 Kick Plates
 - 3.1.3 Auxiliary Hardware
 - 3.1.4 Thresholds
 - 3.1.5 Rain Drips
 - 3.1.6 Weatherseals
 - 3.1.7 Gasketing
 - 3.2 OPERATIONAL TESTS
 - 3.3 FIELD QUALITY CONTROL
 - 3.4 HARDWARE SETS
 - 3.4.1 Hardware Schedule
 - 3.4.2 Schedule of Hardware Groups
- End of Section Table of Contents --

SECTION 08700

BUILDERS' HARDWARE
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
------------	---

ASTM F 883	(1997) Padlocks
------------	-----------------

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA L & R Directory	(Effective thru Jun 1999) Directory of Certified Locks & Latches
----------------------	--

BHMA Closer Directory	(Effective thru Jul (1999) Directory of Certified Door Closers
-----------------------	--

BHMA Exit Devices Directory	(Effective thru Aug 1998) Directory of Certified Exit Devices
-----------------------------	---

BHMA A156.1	(1997) Butts and Hinges
-------------	-------------------------

BHMA A156.2	(1996) Bored and Preassembled Locks and Latches
-------------	---

BHMA A156.3	(1994) Exit Devices
-------------	---------------------

BHMA A156.4	(1992) Door Controls - Closers
-------------	--------------------------------

BHMA A156.5	(1992) Auxiliary Locks & Associated Products
-------------	--

BHMA A156.6	(1994) Architectural Door Trim
-------------	--------------------------------

BHMA A156.7	(1997) Template Hinge Dimensions
-------------	----------------------------------

BHMA A156.8	(1994) Door Controls - Overhead Stops and
-------------	---

Holders

BHMA A156.13	(1994) Mortise Locks & Latches
BHMA A156.15	(1995) Closer Holder Release Devices
BHMA A156.16	(1989) Auxiliary Hardware
BHMA A156.17	(1993) Self Closing Hinges & Pivots
BHMA A156.18	(1993) Materials and Finishes
BHMA A156.19	(1997) Power Assist and Low Energy Power Operated Doors
BHMA A156.20	(1996) Strap and Tee Hinges and Hasps
BHMA A156.21	(1996) Thresholds
BHMA A156.23	(1992) Electromagnetic Locks
BHMA A156.24	(1992) Delayed Egress Locks

DOOR AND HARDWARE INSTITUTE (DHI)

DHI Keying Systems	(1989) Keying Systems and Nomenclature
DHI Locations for CSD	(1997) Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames
DHI Locations for SSD	(1990) Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames
DHI ANSI/DHI A115.1G	(1994) Installation Guide for Doors and Hardware
DHI ANSI/DHI A115-W	(Varies) Wood Door Hardware Standards (Incl A115-W1 thru A115-W9)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1999) Fire Doors and Fire Windows
NFPA 101	(1997; Errata 97-1; TIA-97-1) Life Safety Code
NFPA 105	(1999) Installation of Smoke-Control Door Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The

following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Hardware and Accessories; FIO.

Manufacturer's descriptive data, technical literature, catalog cuts, and installation instructions.

1.3 PREDELIVERY CONFERENCE

Upon approval of the Hardware Schedule, the construction Contractor shall arrange a conference with the hardware supplier, Contracting Officer and the using agency to determine keying system requirements. Location of the key control storage system, set-up and key identification labeling will also be determined.

1.4 DELIVERY, STORAGE, AND HANDLING

Hardware shall be delivered to the project site in the manufacturer's original packages. Each article of hardware shall be individually packaged in the manufacturer's standard commercial carton or container, and shall be properly marked or labeled to be readily identifiable with the approved hardware schedule. Each change key shall be tagged or otherwise identified with the door for which its cylinder is intended. Where double cylinder functions are used or where it is not obvious which is the key side of a door, appropriate instructions shall be included with the lock and on the hardware schedule. Manufacturer's printed installation instructions, fasteners, and special tools shall be included in each package.

1.5 SPECIAL TOOLS

Special tools, such as those supplied by the manufacturer, unique wrenches, and dogging keys, shall be provided as required to adjust hardware items.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

1.7 OPERATION AND MAINTENANCE MANUALS

Maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides shall be provided.

PART 2 PRODUCTS

2.1 GENERAL HARDWARE REQUIREMENTS

Hardware shall conform to the requirements specified herein and the HARDWARE SETS listing at the end of this section. Hardware set numbers correspond to the set numbers shown on the drawings.

2.2 TEMPLATES

Requirements for hardware to be mounted on metal doors or metal frames shall be coordinated between hardware manufacturer and door or frame manufacturer by use of templates and other information to establish location, reinforcement required, size of holes, and similar details. Templates of hinges shall conform to BHMA A156.7.

2.3 HINGES

Hinges shall conform to BHMA A156.1. Hinges used on metal doors and frames shall also conform to BHMA A156.7. Except as otherwise specified, hinge sizes shall conform to the hinge manufacturer's printed recommendations.

2.4 LOCKS AND LATCHES

To the maximum extent possible, locksets, latchsets and deadlocks, and all components thereof, including cylinders and removable cores, shall be the products of a single manufacturer. Lock fronts for double-acting doors shall be rounded. Strikes for wood frames and pairs of wood doors shall be furnished with wrought boxes.

2.4.1 Mortise Lock and Latchsets

Mortise lock, latchsets, and strikes shall be series 1000 and shall conform to BHMA A156.13, operational Grade 1. Mortise type locks and latches for doors 1-3/4 inches thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts. All lock and latchsets shall have handicap accessible lever handles.

2.4.2 Lock Cylinders

Lock cylinders shall comply with BHMA A156.5. Lock cylinder shall have not less than six pins. Cylinders shall have key removable type cores. A grand master keying system shall be provided. Construction interchangeable cores shall be provided.

2.4.3 Lock Trim

Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of BHMA A156.2 or BHMA A156.13, lever handles, roses, and escutcheons shall be 0.050 inch thick, if unreinforced. If reinforced, the outer shell shall be 0.035 inch thick and the combined thickness shall be 0.070 inch except that knob shanks shall be 0.060 inch thick. Lever handles shall be of plain design with ends returned to no more than 1/2 inch from the door face.

2.5 EXIT DEVICES AND EXIT DEVICE ACCESSORIES

2.5.1 Door Coordinator

Door coordinator with carry bar shall be Type 21 and shall be provided for

each pair of doors equipped with an overlapping astragal. The coordinator may be mechanically operated and shall be capable of holding the active door of a pair open until the inactive door has preceded it in the closing cycle. When used as fire exit hardware, the coordinator and carry bar shall be listed or labeled by a nationally recognized independent testing laboratory.

2.5.2 Flush Bolts

Flush bolts shall be installed at the top and bottom of the inactive leaf of pairs of doors where specified in the hardware sets. Flush bolts shall be mortised in the strike edge of the door.

2.6 KEYING

Locks shall be keyed in sets or subsets as scheduled. Locks shall be furnished with the manufacturer's standard construction key system. Change keys for locks shall be stamped with change number and the inscription "U.S. Property - Do Not Duplicate." Keys shall be supplied as follows:

Locks:	3 change keys each lock.
Master keyed sets:	3 keys each set.
Grand master keys:	2 total.
Control keys:	2 total.
Construction keys:	2 total.
Blank keys:	5 total.

The keys shall be furnished to the Contracting Officer arranged for key control system storage in sets or subsets as scheduled.

2.7 DOOR CLOSING DEVICES

Door closing devices shall conform to BHMA A156.4, Grade 1. Closing devices shall be products of one manufacturer for each type specified. The opening resistance of closing devices shall not exceed 15 lb applied at the latch stile or exceed 5 lb where low opening resistance is scheduled.

2.7.1 Surface Type Closers

Surface type closers shall be Grade 1, Series C02000 Standard Cover with options PT-4H and PT-4C for all exterior doors, and PT-4D with back check position valve. Except as otherwise specified, sizes shall conform to the manufacturer's published recommendations. Closers for outswinging exterior doors shall have parallel arms or shall be top jamb mounted. Closers for doors close to a wall shall be of narrow projection so as not to strike the wall at the 90-degree open position.

2.8 ARCHITECTURAL DOOR TRIM

Architectural door trim shall conform to BHMA A156.6.

2.8.1 Door Protection Plates

2.8.1.1 Kick Plates

Kick plates shall be Type J102 stainless steel. Width of plates shall be 2 inches less than door width for single doors and 1 inch less for pairs of doors. Height shall be 16 inches. Edges of metal plates shall be square.

2.9 AUXILIARY HARDWARE

Auxiliary hardware, consisting of door stops, shall conform to BHMA A156.16. Lever extension flush bolts shall be Type L14081.

2.10 MISCELLANEOUS

2.10.1 Metal Thresholds

Thresholds shall conform to BHMA A156.21. Thresholds for exterior doors shall be extruded aluminum of the type indicated and shall provide proper clearance and an effective seal with specified weather stripping. Thresholds for use with floor closers shall conform to BHMA A156.4. Where required, thresholds shall be modified to receive projecting bolts of flush bolts. Thresholds for doors accessible to the handicapped shall be beveled with slopes not exceeding 1:2 and with heights not exceeding 1/2 inch. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.10.2 Rain Drips

Extruded aluminum, not less than 0.07 inch thick, clear anodized. Door sill rain drips shall be 1-1/2 inches to 1-3/4 inches high by 5/8 inch projection. Overhead rain drips shall be approximately 1-1/2 inches high by 2-1/2 inches projection and shall extend 2 inches on either side of the door opening width.

2.10.3 Aluminum Housed Type Weatherseals

Weatherseals of the type indicated shall consist of extruded aluminum retainers not less than 0.07 inch wall thickness with vinyl, neoprene, silicone rubber, polyurethane or vinyl brush inserts. Aluminum shall be clear anodized. Weatherseal material shall be of an industrial/commercial grade. Seals shall remain functional through all weather and temperature conditions. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.10.4 Gasketing

Gasketing shall be a compression type seal, silicon based, self-adhesive product for use on steel door frames with steel doors. Color shall be bronze. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.10.5 Door Stops

Wall stops, floor stops and combination stop and holders shall conform to BHMA A156.16.

2.11 FASTENINGS

Fastenings of proper type, size, quantity, and finish shall be supplied with each article of hardware. Machine screws and expansion shields shall be used for attaching hardware to concrete or masonry. Fastenings exposed to the weather in the finished work shall be of brass, bronze, or stainless steel. Sex bolts, through bolts, or machine screws and grommet nuts, where used on reverse-bevel exterior doors equipped with half-surface or full-surface hinges, shall employ one-way screws or other approved tamperproof screws. Screws for the jamb leaf of half-mortise and full-surface hinges attached to structural steel frames shall be one-way or other approved tamperproof type.

2.12 FINISHES

Unless otherwise specified, finishes shall conform to those identified in BHMA A156.18. Where painting of primed surfaces is required, painting is specified in Section 09900 PAINTING, GENERAL.

PART 3 EXECUTION

3.1 APPLICATION

Hardware shall be located in accordance with DHI Locations for CSD and DHI Locations for SSD, except that deadlocks shall be mounted 48 inches above finish floor. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with DHI ANSI/DHI A115.1G or DHI ANSI/DHI A115-W. Door control devices for exterior doors such as closers and holders, shall be attached to doors with thru bolts and nuts or sex bolts. Alternate fastening methods may be approved by the Contracting Officer when manufacturers' documentation is submitted to verify that the fastening devices and door reinforcements are adequate to resist wind induced stresses. Electric hardware items and access control devices shall be installed in accordance with manufacturer's printed installation procedures.

3.1.1 Door-Closing Devices

Door-closing devices shall be installed and adjusted in accordance with the templates and printed instructions supplied by the manufacturer of the devices. Insofar as practicable, doors opening to or from halls and corridors shall have the closer mounted on the room side of the door.

3.1.2 Kick Plates

Kick plates shall be installed on the push side of single-acting doors and on both sides of double-acting doors.

3.1.3 Auxiliary Hardware

Lever extension flush bolts shall be installed at the top and bottom of the

inactive leaf of pairs of doors. The bottom bolt shall operate into a dust-proof floor strike or threshold.

3.1.4 Thresholds

Thresholds shall be secured with a minimum of three fasteners per single door width and six fasteners per double door width with a maximum spacing of 12 inches. Exterior thresholds shall be installed in a bed of sealant with expansion anchors and stainless steel screws, except that bronze or anodized bronze thresholds shall be installed with expansion anchors with brass screws. Minimum screw size shall be No. 10 length, dependent on job conditions, with a minimum of 3/4 inch thread engagement into the floor or anchoring device used.

3.1.5 Rain Drips

Door sill rain drips shall align with the bottom edge of the door. Overhead rain drips shall align with bottom edge of door frame rabbet. Drips shall be set in sealant and fastened with stainless steel screws.

3.1.6 Weatherseals

Weatherseals shall be located as indicated, snug to door face and fastened in place with color matched metal screws after door and frames have been finish painted. Screw spacing shall be as recommended by manufacturer.

3.1.7 Gasketing

Gasketing shall be installed at the inside edge of the hinge and head and latch sides of door frame. Frames shall be toleranced for a 1/8 inch clearance between door and frame. Frames shall be treated with tape primer prior to installation.

3.2 OPERATIONAL TESTS

Prior to acceptance of any electrical hardware system, an operational test shall be performed to determine if devices are operating as intended by the specifications. Wiring shall be tested for correct voltage, current carrying capacity, and proper grounding. Stray voltages in lock wiring shall be eliminated to prevent locking devices from releasing in critical situations.

3.3 FIELD QUALITY CONTROL

Supplier shall inspect the completed installation and certify that the hardware has been furnished and installed in accordance with the manufacturers' instructions and as specified. The inspection report shall identify any malfunctioning items and recommend adjustment or replacement as appropriate.

3.4 HARDWARE SETS

The contractor is responsible for providing all finish hardware together with all components, accessories and fasteners necessary for a complete and

smooth operating installation.

Provide weatherstripping on exterior doors and silencers on interior doors.

3.4.1 Hardware Schedule

Items in the following hardware schedule are referenced by catalog number to the first named manufacturer. The products listed are considered the minimum level of performance and quality for the hardware.

<u>Item</u>	<u>1st Manufacturer</u>	<u>2nd Manufacturer</u>
Butts, hinges	Stanley	Hager, or equal
Locksets, latches, cylinders, padlocks	Best	Equal approved in advance of bid by Government
Closers	LCN	Sargent, or equal
Silencers, stops, holders	Glynn-Johnson	Builder's Brass, or equal
Automatic flush bolts, Flush bolts, strikes	Ives, Glynn-Johnson	Builder's Brass, or equal
Thresholds	Pemko	Reese, or equal
Cane bolts, foot bolts	Richards-Wilcox	Stanley, or equal

3.4.2 Schedule of Hardware Groups

The associated doors for the hardware groups are shown in the Door Schedule on the Drawings.

Group No. 1:

Door to have:

3 hinges	Stanley FBB 199
1 entrance mortise lockset	Best 35H
1 closer/hold open (low resistance)	LCN 4111-72MC 3049EDA
1 door stop (floor)	Glynn-Johnson FB 36
1 door shoe/drip	Pemko 216BV
1 threshold	Pemko 271B
1 kickplate (on inside	10x34 (630)

Group No. 2:

Active leaf shall be the right hand side of the opening, when inside facing the exterior. Pair of Doors to have:

8 hinges 5x5	Stanley FBB 199
1 mortise lockset	Best 35H
1 manual flush bolts (on inactive leaf)	Glynn-Johnson FB-6
1 push plate (inactive leaf mounted on inside of door)	Hager 30S

2 overhead door closer/holders (mounted on inside of door)	4041 CUSH
1 coordinator	Glynn-Johnson COR-65
2 cane bolts, 24" long	Richards-Wilcox 524-P23
2 cane bolt Keepers (at closed position)	Richards-Wilcox 504
2 custom door stops	See Drawings
1 astragal	Pemko 357SS
2 door shoe/drips	Pemko 216BV
1 threshold	Pemko 271B
2 kickplates	10x34 (630)

Group No. 3:

Each Door to have:

1 Padlock	Schlage PL4003
-----------	----------------

Group No. 4:

Door to have:

3 hinges	Stanley FBB 199
1 privacy latchset	Best 35H
1 closer/hold open (low resistance)	LCN 4111-72MC 3049EDA
1 door bumper (floor)	Glynn-Johnson FB-36

Group No. 5:

Door to have:

3 hinges	Stanley FBB 199
1 classroom mortise lockset	Best 35H
1 door stop (floor)	Glynn-Johnson FB 36

Group No. 6:

Door to have:

3 hinges	Stanley FBB 199
1 storeroom mortise lockset	Best 35H
1 door stop (floor)	Glynn-Johnson FB 36
1 kickplate (on inside)	10x34 (630)

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 09 - FINISHES

SECTION 09250

GYPSUM WALLBOARD

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 QUALIFICATIONS
- 1.4 DELIVERY, STORAGE AND HANDLING
- 1.5 ENVIRONMENTAL CONDITIONS

PART 2 MATERIALS

- 2.1 NON-LOADBEARING STUD WALLS
 - 2.1.1 Studs
 - 2.1.2 Runner Tracks
- 2.2 LOADBEARING STUD WALLS
 - 2.2.1 Studs
 - 2.2.2 Runner Tracks
 - 2.2.3 Bridging
- 2.3 GYPSUM BOARD
 - 2.3.1 Standard Gypsum Board
 - 2.3.2 Water-Resistant Gypsum Board
 - 2.3.3 Water-Resistant Gypsum Backing Panel
- 2.4 TRIM, MOLDINGS, AND ACCESSORIES
 - 2.4.1 Taping and Embedding Compound
 - 2.4.2 Finishing or Topping Compound
 - 2.4.3 All-Purpose Compound
 - 2.4.4 Joint Tape
 - 2.4.5 Trim, Control Joints, Beads, Stops and Nosings
- 2.5 FASTENINGS AND ADHESIVES
 - 2.5.1 Screws
 - 2.5.2 Adhesives

PART 3 EXECUTION

- 3.1 INTERIOR WALL FRAMING
 - 3.1.1 Wall Openings
 - 3.1.2 Wall Control Joints
 - 3.1.3 Blocking
- 3.2 APPLICATION OF GYPSUM BOARD
 - 3.2.1 Water-Resistant Gypsum Board
- 3.3 TRIM, MOLDINGS, AND ACCESSORIES INSTALLATION
- 3.4 GYPSUM BOARD FINISH

3.5 PATCHING

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 09250

GYPSUM WALLBOARD

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|--------------|---|
| ANSI A108.11 | (1992) Interior Installation of
Cementitious Backup Units |
| ANSI A118.9 | (1992) Test Methods and Specifications for
Cementitious Backer Units |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------------|--|
| ASTM A 580/A 580M | (1998) Stainless Steel Wire |
| ASTM A 853 | (1993; R 1998) Steel Wire, Carbon, for
General Use |
| ASTM B 164 | (1998) Nickel-Copper Alloy Rod, Bar, and
Wire |
| ASTM C 36/C 36M | (1999) Gypsum Wallboard |
| ASTM C 79/C 79M | (1997) Treated Core and Nontreated Core
Gypsum Sheathing Board |
| ASTM C 475 | (1994) Joint Compound and Joint Tape for
Finishing Gypsum Board |
| ASTM C 514 | (1996) Nails for the Application of Gypsum
Board |
| ASTM C 557 | (1999) Adhesive for Fastening Gypsum
Wallboard to Wood Framing |
| ASTM C 630/C 630M | (1996a) Water-Resistant Gypsum Backing
Board |
| ASTM C 645 | (2000) Nonstructural Steel Framing Members |

ASTM C 754	(1999a) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C 840	(1999) Application and Finishing of Gypsum Board
ASTM C 931/C 931M	(1998) Exterior Gypsum Soffit Board
ASTM C 955	(1998) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM C 960/C 960M	(1997) Predecorated Gypsum Board
ASTM C 1002	(1998) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases
ASTM C 1047	(1999) Accessories for Gypsum Wallboard and Gypsum Veneer Base
ASTM C 1177/C 1177M	(1999) Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C 1178/C 1178M	(1999) Glass Mat Water-Resistant Gypsum Backing Panel

GYPSUM ASSOCIATION (GA)

GA 214	(1996) Recommended Levels of Gypsum Board Finish
GA 216	(1996) Application and Finishing of Gypsum Board
GA 600	(1997) Fire Resistance Design Manual

UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir	(1999) Fire Resistance Directory (2 Vol.)
--------------------	---

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Gypsum Wallboard; FIO
Water-Resistant Gypsum Board; FIO

Certificates stating that the steel framing and gypsum wallboard meet the specified requirements.

1.3 QUALIFICATIONS

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 5 years of documented successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 3 years of documented successful experience.

1.4 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered in original containers bearing the name of manufacturer, contents, and brand name. Materials shall be stored off the ground in a weathertight structure for protection. Gypsum boards shall be stacked flat, off floor and supported to prevent sagging and warpage. Adhesives and joint materials shall be stored in accordance with manufacturer's printed instructions. Damaged or deteriorated materials shall be removed from jobsite.

1.5 ENVIRONMENTAL CONDITIONS

Environmental conditions for application and finishing of gypsum board shall be in accordance with ASTM C 840. During the application of gypsum board without adhesive, a room temperature of not less than 40 degrees F shall be maintained. During the application of gypsum board with adhesive, a room temperature of not less than 50 degrees F shall be maintained for 48 hours prior to application and continuously afterwards until completely dry. Building spaces shall be ventilated to remove water not required for drying joint treatment materials. Drafts shall be avoided during dry hot weather to prevent materials from drying too rapidly.

PART 2 MATERIALS

2.1 NON-LOADBEARING STUD WALLS

2.1.1 Studs

Studs for non-loadbearing walls shall conform to ASTM C 645. Studs shall be C-shaped, roll formed steel with minimum uncoated design thickness as indicated, made from G40 hot-dip galvanized coated sheet.

2.1.2 Runner Tracks

Floor and ceiling runner tracks shall conform to ASTM C 645. Tracks shall be prefabricated, U-shaped with minimum 1 inch flanges, unpunched web, thickness to match studs, made from G40 hot-dip galvanized coated sheet.

2.2 LOADBEARING STUD WALLS

2.2.1 Studs

Studs for loadbearing walls shall conform to ASTM C 955. Studs shall be C-shaped roll formed steel made from minimum G60 hot-dip galvanized coated sheet. Stud sizes and base metal design thickness shall be as shown.

2.2.2 Runner Tracks

Floor and ceiling runner tracks shall conform to ASTM C 955. Runners shall be prefabricated, U-shaped with minimum 3/4 inch flanges, unpunched web, thickness to match studs, made from G60 hot-dip galvanized coated sheet.

2.2.3 Bridging

Bridging for loadbearing walls shall conform to ASTM C 955. Bridging shall be minimum 3/4 x 3/4 inch cold-rolled steel channel with weld attachment clips at each stud or V-bar type weld or screw attached to each stud flange. Bridging shall be adequate to provide lateral support for the stud.

2.3 GYPSUM BOARD

Gypsum board shall have square-cut ends, tapered or beveled edges and shall be maximum possible length. Gypsum board thickness shall be as shown.

2.3.1 Standard Gypsum Board

Regular gypsum board shall conform to ASTM C 36/C 36M, and shall be 48 inches wide.

2.3.2 Water-Resistant Gypsum Board

Water-resistant gypsum board shall conform to ASTM C 630/C 630M, regular, with water-resistant paper faces, paintable surfaces, and shall be 48 inch width and maximum permissible length.

2.3.3 Water-Resistant Gypsum Backing Panel

Glass mat water-resistant gypsum backing panels shall conform to ASTM C 1178/C 1178M, shall have a water-resistant cove with water and mold/mildew resistant fiberglass faces imbedded into the cove and shall have square edges 48 inches wide by 5/8 inch thick.

2.4 TRIM, MOLDINGS, AND ACCESSORIES

2.4.1 Taping and Embedding Compound

Taping and embedding compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use in embedding tape at gypsum wallboard joints and fastener heads, and shall be compatible with tape and substrate.

2.4.2 Finishing or Topping Compound

Finishing or topping compound shall conform to ASTM C 475. Compound shall

be specifically formulated and manufactured for use as a finishing compound for gypsum board.

2.4.3 All-Purpose Compound

All-purpose compound shall be specifically formulated and manufactured to use as a taping and finishing compound, and shall be compatible with tape and substrate.

2.4.4 Joint Tape

Joint tape shall conform to ASTM C 475 and shall be as recommended by gypsum board manufacturer.

2.4.5 Trim, Control Joints, Beads, Stops and Nosings

Items used to protect edges, corners, and to provide architectural features shall be in accordance with ASTM C 1047.

2.5 FASTENINGS AND ADHESIVES

2.5.1 Screws

Screws shall conform to ASTM C 1002. Screws shall be self-drilling and self-tapping steel, Type S for wood or light-gauge steel framing.

2.5.2 Adhesives

Adhesives shall conform to ASTM C 557. Adhesives shall be formulated to bond gypsum board to wood framing members. For securing gypsum board to metal framing, adhesive shall be as recommended by gypsum board manufacturer.

PART 3 EXECUTION

3.1 INTERIOR WALL FRAMING

Steel framing and furring members shall be installed in accordance with ASTM C 754. Members shall be in alignment with spacings not to exceed the maximum spacings indicated on drawings. Runners shall be aligned accurately at the floor and ceiling and securely anchored.

3.1.1 Wall Openings

The framing system shall provide for the installation and anchorage of the required subframes or finish frames for wall openings at doors, pass-through openings, and access panels. Partitions abutting continuous suspended ceilings shall be strengthened for rigidity at rough openings of more than 30 inches wide. Studs at openings shall be 0.0329 in minimum bare metal thickness and spot grouted at jamb anchor inserts. Double studs shall be fastened together with screws and secured to floor and overhead runners. Two studs shall be used for framing solid-core doors, doors over 36 inches wide and extra-heavy doors such as X-ray room doors.

3.1.2 Wall Control Joints

Control joints for expansion and contraction in the walls shall be constructed with double studs installed 1/2 inch apart in interior walls or wall furrings where indicated on drawings. Control joint spacing shall not exceed 30 feet. Ceiling-height door frames may be used as vertical control joints. Door frames of less than ceiling height may be used as control joints only if standard control joints extend to ceiling from both corners of top of door frame. Control joints between studs shall be filled with firesafing insulation in fire rated partitions.

3.1.3 Blocking

Blocking shall be provided as necessary for mounted equipment. Blocking shall be metal or wood and shall be cut to fit between framing members. Blocking shall be rigidly anchored to the framing members. Under no circumstances will accessories or other wall mounted equipment be anchored directly to gypsum wallboard.

3.2 APPLICATION OF GYPSUM BOARD

Gypsum board shall be installed in accordance with ASTM C 840, AG 214 and GA 216 and as specified. Paragraph 17.3.1 GENERAL of ASTM C 840 which permits usage of water resistant gypsum board as a base for adhesive application of ceramic or plastic tile on ceilings, does not apply. Edges and ends of gypsum boards shall be cut to obtain neat fitting joints. End joints of adjoining boards shall be staggered, and shall be staggered on opposite sides of wall. Boards shall be applied with moderate contact without forcing in place. Holes for pipes, fixtures or other small openings shall be cut with a tool which will provide a neat fit. Screws shall be driven so that the heads are slightly below the plane of paper face. Fracturing the paper face or damaging the core shall be avoided. Trim shall be installed at external and internal angles formed by the intersecting gypsum board surfaces with other surfaces. Corner beads shall be installed to vertical and horizontal corners in accordance with manufacturer's published instructions. Boards of maximum practical length shall be used so that an absolute minimum number of end joints occur. Gypsum board partitions in rooms with ceiling heights less than 10 feet shall have full height boards installed vertically with no end joints in the gypsum installation.

3.2.1 Water-Resistant Gypsum Board

Water-resistant gypsum board shall be installed at the locations indicated.

3.3 TRIM, MOLDINGS, AND ACCESSORIES INSTALLATION

Trim, moldings and accessories shall be installed in accordance with GA 216.

3.4 GYPSUM BOARD FINISH

Gypsum board shall be finished in accordance with ASTM C 840, GA 214 and GA 216. Plenum areas above ceilings shall be finished to Level 1 in accordance with GA 214. Water resistant gypsum backing board, ASTM C 630/C

630M, to receive ceramic tile shall be finished to Level 2 in accordance with GA 214. Walls and ceilings to receive a heavy-grade wall covering or heavy textured finish before painting shall be finished to Level 3 in accordance with GA 214. Walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings shall be finished to Level 4 in accordance with GA 214. Unless otherwise specified, all gypsum board walls, partitions and ceilings shall be finished to Level 5 in accordance with GA 214.

3.5 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum board smooth, uniform in appearance, and ready to receive finish as specified.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 09 - FINISHES

SECTION 09650

RESILIENT FLOORING

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY AND STORAGE
- 1.4 ENVIRONMENTAL REQUIREMENTS
- 1.5 SCHEDULING
- 1.6 WARRANTY
- 1.7 EXTRA MATERIALS

PART 2 PRODUCTS

- 2.1 SHEET VINYL FLOORING
- 2.2 INTEGRAL COVED BASE
- 2.3 ADHESIVE
- 2.4 POLISH
- 2.5 CAULKING AND SEALANTS
- 2.6 MANUFACTURER'S COLOR AND TEXTURE

PART 3 EXECUTION

- 3.1 EXAMINATION/VERIFICATION OF CONDITIONS
- 3.2 SURFACE PREPARATION
- 3.3 MOISTURE TEST
- 3.4 INSTALLATION OF VINYL-COMPOSITION TILE AND SOLID VINYL TILE
- 3.5 INSTALLATION OF SHEET VINYL FLOORING
- 3.6 INSTALLATION OF INTEGRAL COVED BASE
- 3.7 CLEANING
- 3.8 PROTECTION

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 09650

RESILIENT FLOORING

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2240	(1997) Rubber Property - Durometer Hardness
ASTM D 4078	(1992; R 1996) Water Emulsion Floor Polish
ASTM E 648	(1997) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM E 662	(1995) Specific Optical Density of Smoke Generated by Solid Materials
ASTM F 1066	(1995a) Vinyl Composition Floor Tile
ASTM F 1303	(1997) Sheet Vinyl Floor Covering with Backing
ASTM F 1344	(1993) Rubber Floor Tile
ASTM F 1700	(1996) Solid Vinyl Floor Tile

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Resilient Flooring and Accessories; FIO

Manufacturer's descriptive data and installation instructions including cleaning and maintenance instructions.

SD-14 Samples

Flooring; FIO

Three samples of each indicated color and type of flooring and base.
Sample size shall be minimum 2-1/2 x 4 inches.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers bearing the manufacturer's name, project identification, and handling instructions. Materials shall be stored in a clean dry area with temperature maintained above 70 degrees F for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations. Materials shall be protected from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 70 degrees F and below 100 degrees F for 2 days before application, during application and 2 days after application. A minimum temperature of 55 degrees F shall be maintained thereafter.

1.5 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

1.7 EXTRA MATERIALS

Extra flooring material of each color and pattern shall be furnished at the rate of 5 square feet for each 1000 square feet of sheet flooring installed.
Extra materials shall be from the same lot as those installed.

PART 2 PRODUCTS

2.1 SHEET VINYL FLOORING

Sheet vinyl flooring shall be composed of a homogeneous, vinyl composition. Flooring shall be not less than 72 inches wide. Sheet vinyl flooring with backing shall conform to ASTM F 1303. Sheet vinyl flooring without backing shall meet the overall thickness 0.080 inches, composition, flexibility, indentation, and the solvent resistance requirements of ASTM F 1303, Type II. The solid vinyl color and pattern shall extend through the total thickness of the material. High quality vinyl welding rods for heat welding of joints shall be provided.

2.2 INTEGRAL COVED BASE

A metal square cap strip and vinyl, rubber, or wood fillet strip with a minimum radius of 3/4 inch shall be provided for integral coved bases as shown.

2.3 ADHESIVE

Adhesive for flooring and wall base shall be as recommended by the flooring manufacturer.

2.4 POLISH

Polish shall conform to ASTM D 4078.

2.5 CAULKING AND SEALANTS

Caulking and sealants shall be in accordance with Section 07900 JOINT SEALING.

2.6 MANUFACTURER'S COLOR AND TEXTURE

Color and texture shall be in accordance with Section 09915 COLOR SCHEDULE.

PART 3 EXECUTION

3.1 EXAMINATION/VERIFICATION OF CONDITIONS

The Contractor shall examine and verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Government.

3.2 SURFACE PREPARATION

Flooring shall be in a smooth, true, level plane, except where indicated as sloped. Before any work under this section is begun, all defects such as rough or scaling concrete, low spots, high spots, and uneven surfaces shall have been corrected, and all damaged portions of concrete slabs shall have been repaired as recommended by the flooring manufacturer. Concrete curing compounds, other than the type that does not adversely affect adhesion, shall be entirely removed from the slabs. Paint, varnish, oils, release agents, sealers, waxers, and adhesives shall be removed, as recommended by the flooring manufacturer.

3.3 MOISTURE TEST

The suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content shall be determined by a moisture test as recommended by the flooring manufacturer.

3.4 INSTALLATION OF VINYL-COMPOSITION TILE AND SOLID VINYL TILE

Tile flooring shall be installed with adhesive in accordance with the manufacturer's installation instructions. Tile lines and joints shall be kept square, symmetrical, tight, and even. Edge width shall vary as

necessary to maintain full-size tiles in the field, but no edge tile shall be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Edge tile shall be cut, fitted, and scribed to walls and partitions after field flooring has been applied.

3.5 INSTALLATION OF SHEET VINYL FLOORING

Sheet vinyl flooring shall be installed with adhesive in accordance with the manufacturer's written installation instructions. Flooring shall be fitted to the room by hand cutting, straight scribing, or pattern scribing as necessary to suit job conditions. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Seams shall be cut by overlapping or underscribing as recommended by the manufacturer. Seams and edges of sheet vinyl flooring shall be bonded or welded as recommended by the manufacturer. Flooring shall be installed with an integral coved base.

3.6 INSTALLATION OF INTEGRAL COVED BASE

Integral coved base shall be formed by extending the flooring material, length as indicated, onto the wall surface. Cove shall be supported by a plastic, rubber or wood coved filler having a minimum radius of 3/4 inch. Coved base shall be installed with adhesive in accordance with the manufacturer's written instructions. A metal cap strip shall be provided at the top of the base. Voids along the top edge of base at masonry walls shall be filled with caulk.

3.7 CLEANING

Immediately upon completion of installation of tile in a room or an area, flooring and adjacent surfaces shall be cleaned to remove all surplus adhesive. After installation, flooring shall be washed with a cleaning solution, rinsed thoroughly with clear cold water, and, given two coats of polish in accordance with manufacturers written instructions. After each polish coat, floors shall be buffed to an even luster with an electric polishing machine.

3.8 PROTECTION

From the time of laying until acceptance, flooring shall be protected from damage as recommended by the flooring manufacturer. Flooring which becomes damaged, loose, broken, or curled shall be removed and replaced.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 09 - FINISHES

SECTION 09900

PAINTING, GENERAL

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DESCRIPTION
- 1.3 SUBMITTALS
- 1.4 PACKAGING, LABELING, AND STORING
- 1.5 ENVIRONMENTAL CONDITIONS
- 1.6 SAFETY AND HEALTH
 - 1.6.1 Worker Exposures
 - 1.6.2 Toxic Compounds
 - 1.6.3 Training
 - 1.6.4 Coordination

PART 2 PRODUCTS

- 2.1 PAINT
 - 2.1.1 Colors and Tints
 - 2.1.2 Mildewcide and Insecticide
 - 2.1.3 Lead
 - 2.1.4 Chromium
 - 2.1.5 Volatile Organic Compound (VOC) Content

PART 3 EXECUTION

- 3.1 PROTECTION OF AREAS NOT TO BE PAINTED
- 3.2 SURFACE PREPARATION
 - 3.2.1 Concrete and Masonry Surfaces
 - 3.2.2 Ferrous Surfaces
 - 3.2.3 Nonferrous Metallic Surfaces
 - 3.2.4 Gypsum Board Surfaces
- 3.3 MIXING AND THINNING
- 3.4 APPLICATION
 - 3.4.1 Ventilation
 - 3.4.2 Respirators
 - 3.4.3 First Coat
 - 3.4.4 Timing
 - 3.4.5 Fillers
 - 3.4.5.1 Latex Filler
 - 3.4.6 Ferrous-Metal Primer
- 3.5 PIPE COLOR CODE MARKING
- 3.6 SURFACES TO BE PAINTED

3.7 SURFACES NOT TO BE PAINTED

3.8 CLEANING

3.9 PAINTING SCHEDULES

-- End of Section Table of Contents --

SECTION 09900

PAINTING, GENERAL
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH Limit Values	(1999) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices
--------------------	---

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 150	(1998a) Portland Cement
ASTM D 3273	(1994) Resistance to Growth of Mold on the Surface of Interior Coating in an Environmental Chamber
ASTM D 3274	(1995) Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation
ASTM D 4214	(1998) Evaluating Degree of Chalking of Exterior Paint Films
ASTM D 4258	(1999) Surface Cleaning Concrete for Coating

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1500	(Rev A; Notice 1) Sealer, Surface (Latex Block Filler)
CID A-A-1546	(Rev A; Canc. Notice 1)) Rubbing Varnish
CID A-A-1632	(Basic) Varnish, Asphalt
CID A-A-1788	(Canc. Notice 1)) Varnish, Oil; Interior
CID A-A-2246	(Rev B) Paint, Latex

CID A-A-2247	(Basic) Paint, Latex (Semigloss, Interior)
CID A-A-2248	(Basic) Paint, Latex, (Flat, Interior)
CID A-A-2335	(Canc. Notice 1) Sealer, Surface (Varnish Type, Wood and Cork Floors)
CID A-A-2336	(Rev A) Primer Coating (Alkyd, Exterior Wood, White and Tints)
CID A-A-2339	(Canc. Notice 1) Stain (Wood, Solvent-Dye Type)
CID A-A-2542	Sealer, Terrazzo and Concrete Floors, Waterbased
CID A-A-2834	(Basic) Urethane, Waterborne (Low VOC, Clear)
CID A-A-2867	Coating, Polyurethane, Single Component Moisture Cure, Alipathic
CID A-A-2962	(Rev A) Enamel, Alkyd (Metric)
CID A-A-2994	Primer Coating, Interior, for Walls and Wood

FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(Rev J) Obstruction Marking and Lighting
------------------	--

FEDERAL SPECIFICATIONS (FS)

FS TT-C-542	(Rev E) Coating, Polyurethane, Oil-Free, Moisture Curing
FS TT-C-555	(Rev B; Am 1) Coating, Textured (for Interior and Exterior Masonry Surfaces)
FS TT-E-2784	(Rev A) Enamel (Acrylic-Emulsion, Exterior Gloss and Semigloss) (Metric)
FS TT-P-28	(Rev G; Notice 1) Paint, Aluminum, Heat Resisting (1200 Degrees F.)
FS TT-S-708	(Rev A; Am 2; Notice 1) Stain, Oil; Semi-Transparent, Wood, Exterior
FS TT-S-001992	(Basic; Notice 1) Stain, Latex, Exterior for Wood Surfaces

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 5	(1995) Zinc Dust, Zinc Oxide and Phenolic
--------------	---

Varnish Paint

SSPC Paint 18	(1991) Chlorinated Rubber Intermediate Coat Paint
SSPC Paint 20	(1991) Zinc-Rich Primers (Type I - "Inorganic" and Type II - "Organic")
SSPC Paint 23	(1991) Latex Primer for Steel surfaces
SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)
SSPC SP 1	(1982) Solvent Cleaning
SSPC SP 2	(1995) Hand Tool Cleaning
SSPC SP 3	(1995) Power Tool Cleaning
SSPC SP 6/NACE 3	(1994) Commercial Blast Cleaning
SSPC SP 7/NACE 4	(1994) Brush-Off Blast Cleaning

1.2 DESCRIPTION

This section includes painting of architectural elements (mainly Operations Building and existing Building 701). For painting of all exposed metal and steel pipes and mechanical equipment, refer to Section 09960.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Paint; FIO.

The names, quantity represented, and intended use for the proprietary brands of materials proposed to be substituted for the specified materials regardless of quantities in states where VOC content limitations apply.

SD-06 Instructions

Mixing and Thinning; FIO. Application; FIO.

Manufacturer's current printed product description, material safety data sheets (MSDS) and technical data sheets for each coating system. Detailed mixing, thinning and application instructions, minimum and maximum application temperature, and curing and drying times between coats for epoxy, moisture-curing polyurethane, and liquid glaze coatings. Detailed

application instructions for textured coatings shall be provided.

SD-13 Certificates

Lead; FIO. Mildewcide and Insecticide; FIO. Volatile Organic Compound (VOC) Content; FIO.

Certificate stating that paints for interior use contain no mercurial mildewcide or insecticide. Certificate stating that paints proposed for use contain not more than 0.06 percent lead by weight of the total nonvolatile. Certificate stating that paints proposed for use meet Federal VOC regulations and those of the of the local Air Pollution Control Districts having jurisdiction over the geographical area in which the project is located.

1.4 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons.

Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 40 and 95 degrees F. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

1.5 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 45 and 95 degrees F when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings.

Water-thinned coatings shall be applied only when ambient temperature is between 50 and 90 degrees F. Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

1.6 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.6.1 Worker Exposures

Exposure of workers to hazardous chemical substances shall not exceed limits established by ACGIH Limit Values, or as required by a more stringent applicable regulation.

1.6.2 Toxic Compounds

Toxic products having ineffective physiological warning properties, such as no or low odor or irritation levels, shall not be used unless approved by the Contracting Officer.

1.6.3 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material data safety sheets (MDSS) and shall be informed of potential health and safety hazard and protective controls associated with materials used on the project. An affected work area is one which may receive mists and odors from the painting operations. Workers involved in preparation, painting and clean-up shall be trained in the safe handling and application, and the exposure limit, for each material which the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

1.6.4 Coordination

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from preparation, painting and clean-up operations.

PART 2 PRODUCTS

2.1 PAINT

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion filler, and other coatings, whether used as prime, intermediate, or finish coat. Paint shall conform to the requirements listed in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 50 gallons or less, an approved first-line proprietary paint material with similar intended formulation, usage and color to that specified may be used. Additional requirements are as follows:

2.1.1 Colors and Tints

Colors shall be as selected from manufacturer's standard colors, as indicated. Manufacturer's standard color is for identification of color only. The color of the undercoats shall vary slightly from the color of the next coat.

2.1.2 Mildewcide and Insecticide

Paint specified for all coats applied to surfaces in restroom area shall contain a mildewcide that will not adversely affect the color, texture, or durability of the coating. The mildewcide shall be incorporated into the paint by the manufacturer and shall attain a surface disfigurement rating of 8 or greater when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274. Mercurial mildewcide shall not be used in

interior paint. Insecticides shall not be used in paint.

2.1.3 Lead

Paints containing lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal) shall not be used.

2.1.4 Chromium

Paints containing zinc chromate or strontium chromate pigments shall not be used.

2.1.5 Volatile Organic Compound (VOC) Content

Paints shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards and shall conform to the requirements and restrictions of the local air quality management district.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

3.2 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.2.1 Concrete and Masonry Surfaces

Concrete, stucco and masonry surfaces shall be allowed to dry at least 30 days before painting. Surfaces shall be cleaned in accordance with ASTM D 4258. Glaze, efflorescence, laitance, dirt, grease, oil, asphalt, surface deposits of free iron and other foreign matter shall be removed prior to painting.

3.2.2 Ferrous Surfaces

Ferrous surfaces including those that have been shop-coated, shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1. Surfaces that contain loose rust, loose mill scale, and other foreign substances

shall be cleaned mechanically with hand tools according to SSPC SP 2, power tools according to SSPC SP 3 or by sandblasting according to SSPC SP 7/NACE 4. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

3.2.3 Nonferrous Metallic Surfaces

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1.

3.2.4 Gypsum Board Surfaces

Gypsum board surfaces shall be dry and shall have all loose dirt and dust removed by brushing with a soft brush, rubbing with a cloth, or vacuum-cleaning prior to application of the first-coat material. A damp cloth or sponge may be used if paint will be water-based.

3.3 MIXING AND THINNING

When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.4 APPLICATION

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

3.4.1 Ventilation

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed limits as established by ACGIH Limit Values, or as required by a more stringent applicable regulation. Interior work zones having a volume of 10,000 cubic feet or

less shall be ventilated at a minimum of 2 air exchanges per hour. Ventilation in larger work zones shall be maintained by means of mechanical exhaust. Solvent vapors shall be exhausted outdoors, away from air intakes and workers. Return air inlets in the work zone shall be temporarily sealed before start of work until the coatings have dried.

3.4.2 Respirators

Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

3.4.3 First Coat

The first coat on plaster, gypsum wallboard, and other surfaces shall include repeated touching up of suction spots or overall application of primer or sealer to produce uniform color and gloss. Excess sealer shall be wiped off after each application.

3.4.4 Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

3.4.5 Fillers

3.4.5.1 Latex Filler

Latex filler, CID A-A-1500, shall be applied according to the manufacturer's instructions. Surface voids shall be filled and excess filler shall be removed from the surface with a rubber squeegee. The filler shall be allowed to dry the length of time specified by the manufacturer prior to applying successive coats of paint.

3.4.6 Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

3.5 PIPE COLOR CODE MARKING

TABLE II. COLOR CODE MARKING SIZES

Outside Diameter of Pipe Covering (Inches)	Length of Color Band (inches)	Arrow Length x Width (Inches)	Size of Legend Letters and Numerals (Inches)
Less than 1-1/2	8	8 x 2-1/4	1/2
1-1/2 to 2-3/8	8	8 x 2-1/4	3/4
2-1/2 to 7-7/8	12	8 x 2-1/4	1-1/4
8 to 10	24	12 x 4-1/2	2-1/2
Over 10	32	12 x 4-1/2	3-1/2

3.6 SURFACES TO BE PAINTED

Surfaces listed in the painting schedules at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled.

3.7 SURFACES NOT TO BE PAINTED

Surfaces of CMU, hardware, fittings, and other factory finished items shall not be painted.

3.8 CLEANING

Cloths, cotton waste and other debris that might constitute a fire hazard shall be placed in closed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable.

3.9 PAINTING SCHEDULES

The following painting schedules identify the surfaces to be painted and prescribe the paint to be used and the number of coats of paint to be applied. Contractor options are indicated by -----or----- between optional systems or coats.

EXTERIOR PAINTING SCHEDULE

<u>Surface</u>	<u>First Coat</u>	<u>Second Coat</u>	<u>Third Coat</u>
Concrete masonry units.	Cement-emulsion filler	FS TT-E-2784 Type III	None
	CID A-A-1500	FS TT-E-2784 Type III	None
	FS TT-E-2784 Type III	FS TT-E-2784 Type III	None

NOTE: Cement-emulsion filler coat shall be acrylic-based and shall consist of the following ingredients in the proportion stated: white portland cement, ASTM C 150, Type I, 16.5 pounds; aggregate 33.5 pounds; mixing liquid, factory-prepared acrylic containing 46 to 47 percent solids, 0.75 gallon; potable water 1.0 gallon maximum; exterior emulsion paint, FS TT-E-2784 Type III 1.0 gallon. Aggregate shall consist of Washed silica sand of the following gradation:

<u>U.S. Sieve Size</u>	<u>Percent Sand (by Weight)</u> <u>Passing Individual Sieve</u>
0.850 mm (20)	100
0.600 mm (30)	95 - 100
0.300 mm (50)	30 - 65
0.150 mm (100)	0 - 10
0.075 mm (200)	0 - 1

INTERIOR PAINTING SCHEDULE

<u>Surface</u>	<u>First Coat</u>	<u>Second Coat</u>	<u>Third Coat</u>
Gypsum board, concrete, and concrete masonry units	CID A-A-2994 Type II	CID A-A-2246	CID A-A-2246 on gypsum board faced with recycled paper
not requiring a smooth finish, unless otherwise specified		-----or----- CID A-A-2247	CID A-A-2247 on gypsum board faced with recycled paper
		-----or----- CID A-A-2248	CID A-A-2248 on gypsum board faced with recycled paper
Gypsum board: in shower areas, and areas requiring a high degree of sanitation, unless otherwise specified.	CID A-A-2994 Type II	FS TT-E-2784 Type II	FS TT-E-2784 Type II on gypsum board faced with recycled paper
Galvanized metal:	FS TT-E-2784 Type III	FS TT-E-2784 Type II	FS TT-E-2784 Type II
Ferrous Metal: Convactor enclosures, electrical conduit runs: metallic tubing uninsulated ducts and pipes, pipe hangers, louvers, grilles, and air outlets, in areas having painted adjacent surfaces.	SSPC Paint 23	None	None

INTERIOR PAINTING SCHEDULE

<u>Surface</u>	<u>First Coat</u>	<u>Second Coat</u>	<u>Third Coat</u>
<hr/>			
Aluminum and Galvanized Surface Metal:			
Convactor	FS TT-E-2784	CID A-A-2246	CID A-A-2246
enclosures,		-----or-----	
electrical		CID A-A-2247	CID A-A-2247
conduit runs		-----or-----	
metallic tubing		CID A-A-2248	CID A-A-2248
uninsulated			
ducts and pipes,			
pipe hangers,			
louvers, grilles,			
and air outlets,			
in areas having			
painted adjacent			
surfaces.			

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 09 - FINISHES

SECTION 09915

COLOR SCHEDULE

03/01

PART 1 GENERAL

- 1.1 GENERAL
- 1.2 SUBMITTALS

PART 2 PRODUCTS

- 2.1 REFERENCE TO MANUFACTURER'S COLOR
- 2.2 COLOR SCHEDULE
 - 2.2.1 Exterior Walls
 - 2.2.2 Exterior Trim
 - 2.2.3 Exterior Roof
 - 2.2.4 Interior Floor Finishes
 - 2.2.5 Interior Wall Finishes
 - 2.2.6 Interior Ceiling Finishes
 - 2.2.7 Interior Trim
 - 2.2.8 Interior Miscellaneous

PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 09915

COLOR SCHEDULE
03/01

PART 1 GENERAL

1.1 GENERAL

This section covers only the color of the exterior and interior materials and products that are exposed to view in the finished construction. The word "color" as used herein includes surface color and pattern. Requirements for quality and method of installation are covered in other appropriate sections of the specifications. Specific locations where the various materials are required are shown on the drawings. Items not designated for color in this section may be specified in other sections. When color is not designated for items, the Contractor shall propose a color for approval.

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-14 Samples

Color boards; GA.

Three (3) sets of color boards, 30 days after the Contractor is given Notice to proceed, complying with the following requirements:

- a. Color boards shall reflect all actual finish textures, patterns, and colors required for this contract.
- b. Materials shall be labeled with the finish type, manufacturer's name, pattern, and color reference.
- c. Samples shall be on size A4 or 8-1/2 by 11 inch boards with a maximum spread of size A1 or 25-1/2 by 33 inches for foldouts.
- d. Samples for this color board are required in addition to samples requested in other specification sections.

PART 2 PRODUCTS

2.1 REFERENCE TO MANUFACTURER'S COLOR

Where color is shown as being specific to one manufacturer, an equivalent

color by another manufacturer may be submitted for approval. Manufacturers and materials specified are not intended to limit the selection of equal colors from other manufacturers.

2.2 COLOR SCHEDULE

The color schedule lists the colors, patterns and textures required for exterior and interior finishes, including both factory applied and field applied colors.

2.2.1 Exterior Walls

Exterior wall colors shall apply to exterior wall surfaces including recesses at entrances and projecting vestibules. Conduit shall be painted to closely match the adjacent surface color. Wall color shall be provided to match the colors in the schedule at the end of this section.

2.2.2 Exterior Trim

Exterior trim shall be provided to match the colors in the schedule at the end of this section.

2.2.3 Exterior Roof

Roof color shall apply to exterior roof surfaces including sheet metal flashings and copings, mechanical units, roof trim, pipes, conduits, electrical appurtenances, and similar items. Roof color shall be provided to match the colors in the schedule at the end of this section.

2.2.4 Interior Floor Finishes

Flooring materials shall be provided to match the colors in the schedule at the end of this section.

2.2.5 Interior Wall Finishes

Interior wall color shall apply to the entire wall surface, including reveals, vertical furred spaces, grilles, diffusers, electrical and access panels, and piping and conduit adjacent to wall surfaces unless otherwise specified. Items not specified in other paragraphs shall be painted to match adjacent wall surface. Wall materials shall be provided to match the colors in the schedule at the end of this section.

2.2.6 Interior Ceiling Finishes

Ceiling colors shall apply to ceiling surfaces including soffits, furred down areas, grilles, diffusers, registers, and access panels. Ceiling color shall also apply to joist, underside of roof deck, and conduit and piping where joists and deck are exposed and required to be painted. Ceiling materials shall be provided to match the colors in the schedule at the end of this section.

2.2.7 Interior Trim

Interior trim shall be provided to match the colors in the schedule at the end of this section.

2.2.8 Interior Miscellaneous

Miscellaneous items shall be provided to match the colors in the schedule at the end of this section.

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 09 - FINISHES

SECTION 09960

PROTECTIVE COATINGS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DESCRIPTION
- 1.3 DEFINITIONS
- 1.4 SUBMITTALS
- 1.5 QUALITY ASSURANCE
- 1.6 WARNINGS
- 1.7 DELIVERY, STORAGE AND HANDLING
- 1.8 PROJECT CONDITIONS
- 1.9 COLORS AND SAMPLES

PART 2 PRODUCTS

- 2.1 MATERIALS
- 2.2 COATING SYSTEMS

PART 3 EXECUTION

- 3.1 SURFACE PREPARATION
- 3.2 PIPE AND EQUIPMENT IDENTIFICATION
- 3.3 FIELD QUALITY CONTROL
- 3.4 CLEANING AND COMPLETION
- 3.5 SPARE PAINT
- 3.6 APPLICATION SCHEDULE

-- End of Section Table of Contents --

SECTION 09960

PROTECTIVE COATINGS
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

Where standards of surface preparation are described by citing SSPC specification numbers reference is made to the "Steel Structures Painting Manual" Volume 2 published by the Steel Structures Painting Council.

American Society of Testing and Materials (ASTM)

ASTM D4060	Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D2794	Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D4541	Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM F1249	Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

1.2 DESCRIPTION

A. Section Includes:

1. All exposed metal and steel pipes and mechanical equipment except for the following:
 - a. Items painted under Section 09900.
 - b. Pumps
 - c. Sprinkler heads
 - d. Stainless steel, louvers
 - e. Fire extinguishers, emergency shower and similar items
 - f. Rubber
 - g. Plastic pipe, including: polyvinyl chloride, polyethylene, and polypropylene piping and similar items
 - h. Nameplates and grease fittings
 - i. Pre-finished or anodized aluminum

B. Related Sections:

1. Section 10400: Identifying Devices
2. Section 09900: Painting - painting of architectural elements

C. The Contractor is to base this bid on using the products specified. If the products specified are not available in formulations that meet applicable regulations on volatile organic compounds (VOC) levels at time of application, the Contractor is to submit for review products of equivalent quality and function that comply with regulations in effect at that time. A reasonable difference in cost of material between the first named items specified and the products that are required to meet regulations that change after the bid date and are in effect at the time of application may be approved for payment by Change Order.

1.3 DEFINITIONS

- A. Dry Film Thickness (DFT) - The prime coat and the sum of all fully cured applied coats for the paint system.
- B. Exterior Surface - Surface that is not inside a building or structure and is exposed to the weather.
- C. Stripe Coat - Coating applied to the edge, corner, welds or bolts that is applied prior to application of additional system coats.
- D. Submerged - Surfaces that are under water or the vertical extension of those walls that are partly under water during normal operating conditions.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Storage and Handling; FIO.

Provide Material Safety Data Sheets (MSDSs) for all products.

SD-07 Schedules

Materials; FIO.

Prior to ordering material, submit a complete schedule of materials to be used. Include manufacturer's brand name, product name, and designation number for each coat of each system to be used.

SD-09 Reports

Paint Products; FIO.

Provide the following information on each paint product:

1. Abrasion resistance, ASTM D4060, 1 kg load at 1000 cycles, CS-17

wheel.

2. Impact resistance, ASTM D2794, direct and reverse.
3. Moisture vapor transmission, ASTM F1249.
4. Adhesion, ASTM D4541.

If materials other than those listed are submitted, submit additional information to fully define the proposed substitution. The Contracting Officer may further require the Contractor to furnish additional test results from an independent paint laboratory comparing the proposed substitution with one of the named products, at no additional cost to the Government. For substituted materials, provide a list of references, including contact person and phone number, where proposed substitute paint system has been used in similar exposures. Provide a minimum of five references (no duplicate owners or agencies).

SD-13 Certificates

Manufacturer's Certification; FIO.

That products furnished meet applicable Air Quality Management District regulations as to allowable volatile organic compound (VOC) content for the place of application and use intended.

SD-14 Samples

Label/Stenciling Samples; FIO

Color Code Charts; FIO.

Submit a full range of the manufacturer's standard and let down finish colors for review and selection by the Contracting Officer. After final colors have been selected, submit two 8-1/2- x 11-inch samples on cardboard of each color indexed as to manufacturer and color designation. Color chips 3/4-inch x 1-1/2-inch may be used for pipe color codes.

Submit four pipe and equipment color code charts, 11 x 14 inches in size, with typed labels and using color chips. Upon favorable review, frame charts and mount under glass, suitable for hanging in work areas.

1.5 QUALITY ASSURANCE

A. Environmental Regulatory Requirements:

1. All work, material, procedures, and practices under this Section shall conform with requirements of the local Air Resources Board or Air Quality Management District having jurisdiction. Prime or finish coat painting done in locations other than the project site shall be in accordance with air quality regulations in effect at the place the coating is applied. Products specified herein are, to the best of the Design Contracting Officer's knowledge, in compliance with the applicable volatile organic compounds (VOC, measured in grams per liter by weight of coating as applied, excluding water and color added to be base tint) levels allowable at the date these Specifications were issued for bid.
2. The Air Resources Board or Air Quality Management District having jurisdiction may prohibit the sale or application of paints and enamels

containing more than the stipulated percentages of volatile organic solvents manufactured after a stated date. Provide material meeting applicable regulations effective at the date of manufacture, or if not available, provide top of the line materials developed as replacements for specified materials and meeting applicable regulations as to VOC solvents content.

3. If the Contractor applies coatings that have been modified or thinned other than as recommended by manufacturer, he will be responsible for any fines, costs, remedies or legal actions that may result.

1.6 WARNINGS

A. Be advised that application of paint, epoxy and protective coating materials may be hazardous. Take all necessary precautions to ensure the safety of workers and property.

B. Be advised that as a part of this work abrasive blasting is required. This may require the use of special equipment. Become familiar with the existing site conditions and take all steps necessary to protect adjacent facilities and personnel, at no additional cost to the Government. In addition, abrasive blasting and painting is called for in, on or around mechanical equipment which may be damaged by grit, dust or painting overspray. Mask, wrap, enclose and provide all protection required to safeguard this equipment at no additional cost to the Government.

C. Perform abrasive blasting activities in a manner that will not cause a nuisance to adjacent property and equipment.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver all coating materials in unopened containers with manufacturer's label, which must include name, batch number and date and VOC content.

B. Store in an assigned area onsite with concurrence from the coating manufacturers. Maintain storage area clean and fire safe. Dispose of used rags, thinner and buckets daily. Store solvents in closed approved storage containers.

C. Submerge solvent soaked rags in water.

1.8 PROJECT CONDITIONS

A. Environmental Requirements:

1. Provide ambient temperatures recommended by manufacturer of material to be applied.

2. Provide adequate ventilation.

3. Provide 40- to 50-foot candles of illumination on all surfaces in areas to be painted including floors, walls and ceiling even though they do not require painting.

4. Use temporary dust barriers to close off areas being painted from areas where other work is being performed.

1.9 COLORS AND SAMPLES

- A. Before starting work, obtain favorably reviewed color schedule.
- B. Colors are to be factory mixed, using light-fast colorants proportioned by accurate measurement into proper type base. All coatings must be formulated to perform in the climate and environment to which they will be exposed.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials used in each system shall be the product of one manufacturer.
- B. Shop applied prime coats shall be compatible with the systems included in these specifications.
- C. Substituted coating systems shall be of the same generic type as those specified.
- D. Coating systems shall not contain lead.
- E. Abrasives shall not be classified a hazardous material under California Title 22.
- F. Materials: Paints and protective coatings listed in the Paint Systems and the Schedule in Part 3 of this Section refer to the following manufacturers and are specified as levels of quality. It is understood that the words "or equal" are included herein.

Sherwin Williams (SW)
 Kop Coat (K)
 Tnemec Co. (T)
 Roto Metals (RG)
 Protecto Wrap (PW)
 Tapecoat (TC)
 Chemical Products Co. (ZRC)
 Ameron (A)
 Thermecoat-Welco (TW)
 CRC Industries (CRC)

2.2 COATING SYSTEMS

System 1: General Ferrous Exposed to Atmosphere

1st Coat - bare metal	High Solids Epoxy	(A) Amerlock 400 (T) Series 135
Finish Coat(s)	High Solids Epoxy	(A) Amerlock 400 (T) Series 135
Total DFT = 12 mils		
Final coat for exterior surfaces	Aliphatic Polyurethane	(A) Amercoat 450HS (T) Series 74
DFT = 2 mils additional		

System 2: Galvanized Metal Surface Repair

One Coat:

To be left unpainted:	Eutectic-type repair	(TW) Gal-Viz
		(RG) ReGalv
To be painted:	High zinc content	(ZRC) Cold Galv. Compound
DFT = 2 mils		(CRC) Zinc It

System 3: Submerged Ferrous Metal (Potable Water)

Two coats	High Solids Epoxy	(A) Amerlock 400
DFT = 12 mils		(T) Series 140, Pota-Pox Plus

System 4: Bleeding Surfaces: (Not buried)

1st Coat(s)	High Solids Epoxy	(A) Amerlock 400
		(T) Series 135
2nd Coat	High Solids Epoxy	(A) Amerlock 400
DFT = 12 mils		(T) Series 69
Finish coat - exposed surfaces	Aliphatic Polyurethane	(A) Amercoat 450HS
DFT = 2 mils additional		(T) Series 74

System 5: Prefinished Machinery Coating (Other than prime coat)

One coat	Aliphatic Polyurethane	(A) Amershield
DFT = 2 mils		(T) Series 74

System 6: Galvanized Steel and Non-Ferrous Metals

1st Coat(s)	High Solids Epoxy	(A) Amerlock 400
		(T) Series 135
2nd Coat	High Solids Epoxy	(A) Amerlock 400
DFT = 8 mils		(T) Series 69
Finish coat - exterior surfaces	Aliphatic Polyurethane	(A) Amercoat 450HS
DFT = 2 mils additional		(T) Series 74

System 7: Miscellaneous Service Coating

One full brush coat	Coal Tar	(K) Bituplastic #33
		(T) 46-40 Tnemecol

System 8: Buried Valves

One full brush coat		(PW) 160/160 H Mastic
DFT = 20 - 30 mils		(TC) TC Masti

System 9: Welded Steel Pressure Filters/Tanks

Interior-Three coats min.	High Solids Epoxy	(A) Amercoat 395FD
DFT = 12-15 mils total		(T) Series 140, Pota-Pox Plus
Exterior -		
2 coats	High Solids Epoxy	(A) Amerlock 400
DFT = 5-7 mils each coat		(T) Series 135

System 9: Welded Steel Pressure Filters/Tanks

Finish coat - exterior Aliphatic Polyurethane (A) Amercoat 450HS
surfaces
DFT = 3 mils additional (T) Series 74

System 10: Heat Resistant (NOT USED)

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Prepare surfaces in strict accordance with manufacturer's instructions prior to application. Provide manufacturer's instructions with submittal. Apply first coat immediately after surface preparation. Keep all paints at a consistency and applied in accordance with the printed directions of the manufacturer. The painting shall be done by hand, spray or roller as approved by the manufacturer and Contracting Officer in conformance to individual paint manufacturer's recommendations. The Contracting Officer and paint supplier will review all surfaces to be painted on the job prior to application of any coatings. Once the Contractor begins undercoating or priming, this will be his guarantee that the surface is acceptable to paint. All painted surfaces are to be free from drips, ridges and brush marks. The following stipulations also apply:

1. Thinning permitted only when recommended by the manufacturer and only with thinner recommended for use with the particular product.
2. The use of additives to improve working characteristics or to lengthen or shorten set time is prohibited.
3. Items difficult or impossible to paint after installation are to be painted before installation and touched up after installation.
4. Apply each coat to a uniform, even coating; lay material on in one direction and finish at right angles. Allow material to thoroughly dry between coats. Scuff, sand and remove all runs, sags, overspray, surface roughness and other defects between each coat. Dust and wipe surface clean before applying next coat.
5. Cutting in is to be sharp and straight, free from overlaps or fuzzy edges. Redo any imperfect work.
6. Apply not less than the number of coats or dry film thickness specified. Apply additional coats if required for uniform coverage, full hiding, and to achieve film continuity. Finished work to be uniform in color, full coverage, smooth and free of sags and brush marks.
7. Do not apply coating when temperature is below 55°F or when the temperature of the surface to be painted is less than 4°F over the dew point temperature. Perform coating operations only under favorable environmental conditions. Take all steps necessary to protect and completely cure the work. Correct defective work to the full satisfaction of the Contracting Officer.
8. Apply the last finish coat on all work after all major construction is complete and the work areas have been cleaned up and are dust free.

3.2 PIPE AND EQUIPMENT IDENTIFICATION

A. Identify all piping and equipment exposed to the atmosphere, both interior and exterior, and including pipe located in concrete pipe trenches, by a combination of color coding, stenciling or pressure-sensitive tape and direction arrows.

B. Identify painted pipe 4 inches in diameter and larger by stenciling identification names and directional arrows. Identify unpainted pipe and

pipe less than 4 inches in diameter by color vinyl pressure-sensitive lettered labels and arrows. Place names and arrows every 16 feet and wherever a pipe enters or leaves a room or a pipe trench. Provide lettering size as follows:

<u>Pipe Diameter</u>	<u>Lettering Size* (Height)</u>
1-1/4" or less	1/2"
1-1/2" to 2"	3/4"
2-1/2" to 6"	1-1/4"
8" to 10"	2"
Over 10"	3-1/2"

* All lettering shall be in capital. Submit font type for approval.

C. Provide pipe identification names as listed in the Piping Schedule on except that the Contracting Officer will abbreviate any names exceeding 20 letters. Directional arrows are to be in black and be proportional to lettering. Color of equipment and pipe shall be as shown on a schedule to be provided by the Contracting Officer. Gloss enamel is to be used for stenciling.

D. The Contracting Officer will prepare a color schedule after the protective coatings are favorably reviewed. Notify the Contracting Officer 30 days before the color schedule is needed. Colors will require special mixing. The number of different colors needed will be as indicated by the following schedule.

Process - All the same color

Chemicals - Each in a different color

Water - Each one a different color

Drainage - Sample Drain and Waste Cooling Water one color. All others another color

E. Paint equipment in the same color as the pipe to which it is connected.

F. Paint conduit and ductwork in colors to match adjacent walls/ceilings.

3.3 FIELD QUALITY CONTROL

A. Pinhole and Continuity Testing:

1. After the application of the prime and finish coats of Paint Systems 3 and 9 surface protective coating systems on metal surfaces, perform continuity and pinhole checking by means of a low voltage electrical resistance meter and check thickness with a magnetic thickness gauge to determine that pinhole free condition and specified film thickness of the paint system has been achieved over all of the painted surfaces. Repair all deficiencies in film integrity and thickness in accordance with the manufacturer's instructions.

2. The Contracting Officer or an independent testing consultant may perform its own continuity and pinhole checking and thickness checks in

addition to the Contractor's required tests. The appropriate equipment and necessary support, if requested, is to be provided by the Contractor. Repair any additional deficiencies in film integrity and thickness per the manufacturer's instructions and to the satisfaction of the Contracting Officer.

3. THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE FACT THAT PAST USE OF THIS INSTRUMENT HAS DEMONSTRATED THAT THE PAINTER MUST APPLY AT LEAST TWO AND USUALLY THREE OR MORE STRIPE COATS ALONG ALL EDGES AND ANGLES AND CREVICES FORMED BY JOINING MEMBERS IN ADDITION TO THE COATS SPECIFIED IN ORDER TO ACHIEVE A PINHOLE FREE SURFACE.

B. Adhesion Testing: Where there is a question of paint or coating adhesion to surfaces, demonstrate to the Contracting Officer's satisfaction that the coating adhesion to the area in question is equal to or greater than that which the paint manufacturer literature states may be achieved by his product. An "Elcometer Adhesion Tester" is to be used by the Contractor to accomplish this demonstration.

C. Continuity, Pinhole and Adhesion Testing Support: Provide scaffolding, ladders, lighting and labor as required to facilitate the Contracting Officer's check. Repair any areas damaged during and by the testing operation.

3.4 CLEANING AND COMPLETION

A. At the completion of this portion of the work, remove all debris, remove all paint and stains from work for which paint finish is not intended, touchup all marred surfaces, and leave all buildings and structures in a clean condition, ready for use.

B. Refinish all damaged or imperfect painting to the satisfaction of the Contracting Officer prior to final acceptance of the facility.

C. Finish work, except waterproofing mastics, is to present an even, pleasing and uniform color and appearance. Surfaces exhibiting coatings with shadows, streaks, overlap marks, sags, drips, roughness or non-uniform sheen will be considered as improperly applied and will not be considered acceptable.

D. Leave all machinery nameplate data tags clean and readable and all grease fittings clean and usable.

3.5 SPARE PAINT

Provide a complete blending formula to develop each color used on the project.

3.6 APPLICATION SCHEDULE

Provide coatings in accordance with the following exposure schedule:

<u>Exposure</u>	<u>Surface Preparation</u>	<u>Paint System</u>	<u>Note</u> (see below)
-----------------	----------------------------	---------------------	----------------------------

General ferrous exposed to atmosphere	Bare Metal: Sandblast Shop Primed: Hand Tool Cleaned	1	1
Galvanized metal surface repair	Hand Tool Cleaning	2	2
Submerged ferrous metal	Abrasive Blast except Solvent Clean galvanized items	3	3
Bleeding surface	Solvent Clean per paint manufacturer's recommendations	4	4
Exposed galvanized steel, copper and other non-ferrous metals	Solvent clean, lightly Hand Sand, prewash	6	6
Prefinished machinery coating	Hand Tool Cleaning	5	5
Vent pipes exposed at building roofs and metal mounted in contact with walls	Hand Tool Cleaning	7	7
Buried valves, flanges, etc.	Solvent Clean and Hand Tool Cleaning	8	8
Factory finish coated items not requiring field painting	Touchup	-	9
Welded Steel Pressure Filter	Near White Blast	9	10
Engine Exhaust	Brush Clean	10	11

Notes to Application Schedule

1. These surfaces include, but are not limited to: general miscellaneous ferrous metal; machinery; pumps; blowers; compressors; supports; valve handwheels and stands; valve bodies; piping systems; structural steel; steel elements; except where other systems in this schedule are more specifically applicable.

2. Use galvanize-repair paint to repair-galvanize surfaces to be painted. Use eutectic-type repair to repair-galvanize surfaces to remain unpainted.

3. Apply this system to both ferrous metal and galvanized metal submerged in or suspended over water or sludge. These surfaces include but are not limited to machinery parts, piping, valves, brackets and supports, and miscellaneous supports, braces, and pump columns. Do not blast clean galvanized surfaces, instead provide one prime coat of 40

passivator prior to finish painting. Coat inaccessible surfaces prior to erection.

4. All items furnished with asphalt or coal tar (bleeding) epoxy shop coats which would otherwise be covered by System 1.

5. All piping, valves, pumps, drives, machinery, and equipment that have factory finish coats that will be exposed to atmosphere. This system provides for repair of above named items and color uniformity with rest of field coat items.

6. Exposed metal electric conduit, exposed copper pipe and other non-ferrous metal items.

7. All cast iron soil pipe and associated flashing above the building roof. Also coat metal items which are surface mounted on exterior, basement or gallery masonry walls, plaster walls and concrete surfaces.

Coat such metal items only on the contact surfaces unless otherwise specified; specifically include electrical panels, control cabinets, fixtures and guardrail support brackets.

8. Buried steel and cast-iron valves, operators, steel flanges, and other buried ferrous metals.

9. All panels and equipment with factory finishes identified elsewhere as not requiring field paint, damaged during shipping, storage, or installation: touch-up in the field in a manner compatible with the factory coating with respect to paint type, color, and texture. Touch-up fusion epoxy-coated items only with material provided by the fusion epoxy fabricator. If more than 5% of the surface requires touchup, return the items to the fabricator for recoating.

10. This system shall be applied to the welded steel pressure filters. Filter interiors shall be coated in the supplier's shop. See Section 11357.

11. Exterior surfaces of engine exhaust, rain hood and rain cap where these items are above the roof line.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 10 - SPECIALTIES

SECTION 10050

BUILDING SPECIALTIES

03/01

PART 1 GENERAL

1.1 SUMMARY

1.2 SUBMITTALS

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

2.2 RUBBER SWITCHBOARD MATS

PART 3 EXECUTION

3.1 INSTALLATION

-- End of Section Table of Contents --

SECTION 10050

BUILDING SPECIALTIES
03/01

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire extinguishers and fire extinguisher cabinets.
2. Rubber switchboard mats.

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Product Data; FIO.

Fully describe all products proposed for use.

SD-06 Instructions

Manufacturers Instructions; FIO.

For installation of all items.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Provide surface mount steel cabinets for 18 lb. 4A60BC Fire Extinguishers with door as shown on the Drawings. Cabinet to be 20-gauge steel and have an extinguisher support bracket. Door to have an 18-gauge steel frame on all four sides, a continuous piano hinge and contain a break glass door panel. Baked white enamel finish inside and out. 12-inch by 30-inch by 3-3/4-inch. Larsen Architectural Series; J. L. Industries; or equal.

B. Provide one for each extinguisher cabinet multi-purpose 4A60BC (shipping weight 18 lbs.). Shell of extinguishers shall be painted OSHA Red. All extinguishers shall be by one manufacturer and shall have a State Fire Marshal's inspection and fill tag dated within 90 days of project acceptance and issued by the Fire Marshal of the State in which the extinguisher is installed. Larsen Architectural Series; J. L. Industries;

or equal.

2.2 RUBBER SWITCHBOARD MATS

A. Provide corrugated fiber reinforced rubber mats that conform to ASTM D178 and ANSI J6.7, Type I, oil resistant. Mats shall meet OSHA requirements. Mats for low voltage (below 1 kV) switchboards and switchgear and motor control centers shall be rated for protection for 17,000 volts minimum to ground. Mats for medium voltage (1 kV to 15 kV) switchgear shall be rated 17,000 volts. Test voltage: 30,000 volts.

B. Mat shall be a minimum of 1/4-inch-thick and black in color with beveled edges. Mats shall extend the full width of the equipment (minimum 30 inches). Mats shall be 4 feet deep in front of low voltage equipment and 6 feet deep in front of medium voltage equipment. Provide mats for all switchboards and motor control centers whether shown or not.

C. Installation: Install in front of all switchboards and motor control centers.

PART 3 EXECUTION

3.1 INSTALLATION

A. Fire Extinguishers: Comply with NFPA Standard No. 10. Install cabinets and mount extinguishers where directed and where shown.

B. Install rubber switchboard mats as described in Part 2 in the Electrical Room in front of all electrical panels, MCCs and switchgear.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 10 - SPECIALTIES

SECTION 10200

LOUVERS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUMMARY
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE

PART 2 PRODUCTS

- 2.1 STATIONARY EXTRUDED ALUMINUM FRAMED LOUVERS
- 2.2 MATERIALS/FABRICATION
- 2.3 FINISH

PART 3 EXECUTION

- 3.1 INSTALLATION

-- End of Section Table of Contents --

SECTION 10200

LOUVERS
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

Sheet Metal and Air Conditioning Contractors National Association
(SMACNA)

Air Control Division of the Air Movement and Control Association
(AMCA)

1.2 SUMMARY

A. Section Includes:

1. Wall louvers

B. Related Sections:

1. Section 08110: Steel Doors and Frames
2. Section 09900: Painting, General
3. Section 15895: Air Supply, Distribution, Ventilation, and Exhaust System

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Product Data; FIO.

Fully describe all items proposed for use.

SD-13 Certificates

Certified Test Data; FIO.

Air and acoustic performance of louvers.

1.4 QUALITY ASSURANCE

A. Comply with details and standards in the "Architectural Sheet Metal Manual" published by Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

B. Air Control Division of the Air Movement and Control Association (AMCA) Standard 500 for measuring air performance, water penetration and air leakage and Standard 411 for the AMCA Certified Ratings Program.

PART 2 PRODUCTS

2.1 STATIONARY EXTRUDED ALUMINUM FRAMED LOUVERS

A. Manufacturer: Louver style K6774 exposed vertical mullion type manufactured by Airolite; Construction Specialties; or equal.

B. Design Criteria: Design and test louvers to bear AMCA certified rating seals for air performance and water penetration. Test a 4x4-foot louver with a minimum free area of 7.89 square feet to pass at least 800 FPM through the free area at a pressure drop not exceeding 0.15 in W.G. Limit water penetration to 10 ounces of water per square foot of free area when tested at 720 FPM for 15 minutes per AMCA Standard 500.

2.2 MATERIALS/FABRICATION

A. Provide extruded aluminum framed louvers with exposed jambs and mullions 4 inches deep with blades spaced 3 inches on center. Use aluminum alloy 6063-T52 for all parts.

B. Use extruded blades, 12-gauge (0.81 inches) thick, having a downward turned stiffening leg along the front bottom edge and an up turned leg with a forward facing lip to stop water migration along the top rear edge. Use blades that have an extruded hood on their bottom surface to interlock with mullion support brackets. Set louver blades at a 30° degree angle for exhaust and 45° degree angle for intake.

C. Contain louver blades in a frame made of 3/4 x 4-inch extruded aluminum "C" sections. Where mullions are required use exposed vertical "I" mullion connectors.

D. Provide louvers that have all joints concealed.

E. Continuously weld all joints in the louver assembly using a shielded arc process.

F. Provide 1/2 x 1/2 x 14-gauge aluminum bird screens in folded extruded aluminum frames. Where ductwork is attached to the interior side of louver provide holder for screen frame that can be built into duct work and so arranged that by opening a door in duct, screen can be slid out for cleaning without disassembling duct work. Where there is no ductwork attached to interior of louver, provide a holder for bird screen frame designed so that screen can be removed for cleaning and replaced without using tools.

G Provide all related break shape and extruded aluminum sills, flashings and sub-frames. Flashings shall be 0.050 or thicker as indicated.

H. Provide all required aluminum angles, tees, plates and other shapes required for a complete installation.

2.3 FINISH

Spray-Applied Hylar 5000™/Kynar 500®:

A. Color: Match sample provided by Contracting Officer.

B. Coating thickness: 4-coat 2.13-3.1 mils metallic.

C. Painted Finish Performance Standards:

1. Impact:
 - a. Test Method ASTM D2794; Gardner Variable Impact Tester with 1/2-inch mandrel.
 - b. Coating shall withstand direct and reverse impact of 1.5-inch-pounds/mil substrate thickness.
 - c. Coating shall adhere tightly to metal when subjected to #600 Scotch tape pick-off test. Slight micro-cracking is permissible, but no star cracking shall occur.
2. Adhesion:
 - a. Test Method ASTM D3359; perform at room temperature.
 - b. Coating shall not pickoff when subjected to an 11 x 11 x 1/16-inch grid with reverse impact of 1.5-inch-pounds/mil substrate thickness and taped with #600 Scotch tape.
3. Humidity Resistance:
 - a. Test Method ASTM 2247.
 - b. No formation of blisters shall occur when subjected to condensing water fog at 100°F for 1,000 hours.
4. Salt Spray Resistance:
 - a. Test Method ASTM B117; expose single-coat system to 1,000 hours, using 5% NaCL solution.
 - b. Corrosion creepage from scribe line shall be 1/16-inch .
5. Weather Exposure:
 - a. Accelerated Test Method ASTM D822 for 2,000 hours in Weather-Ometer.
 - b. No checking, crazing or adhesion loss shall occur.
6. Chemical Resistance:
 - a. Acid Pollutants Test Method ASTM D1308 for 10% muriatic acid and 20% sulfuric acid.
 - b. Alkali Resistance Test Method ASTM D1308.
 - c. No loss of adhesion or gloss and no color change shall occur.

PART 3 EXECUTION

3.1 INSTALLATION

A. Protect all aluminum in contact with concrete, plaster, masonry, steel or galvanized metal with a coating of bituminous paint.

B. Install louvers as shown in the Contract Drawings and as shown in

Plates 137B and 139A of the 4th Edition of the SMACNA Architectural Sheet Metal manual.

C. Provide bird screens on all louvers. Install on the interior side. Use stainless steel screws throughout.

D. Install sill flashing as shown detailed and as required to provide a watertight installation.

E. Install sheet metal drip at head of louvers where shown.

F. Apply sealant "B" all around frame, inside and outside in accordance with the requirements of Section 07900.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 10 - SPECIALTIES

SECTION 10400

IDENTIFYING DEVICES

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUMMARY
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE

PART 2 PRODUCTS

- 2.1 SIGNS
- 2.2 TAGS

PART 3 EXECUTION

- 3.1 SIGN INSTALLATION
- 3.2 TAGS
- 3.3 PIPE MARKERS

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 10400

IDENTIFYING DEVICES

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A13.1	American National Standard Specifications "Scheme for the Identification of Piping Systems."
------------	--

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 704	System for the identification of the fire hazards of materials.
----------	--

1.2 SUMMARY

- A. Section Includes: Signs, decals, tags, and pipe markers.
- B. Related Sections:
 - 1. Section 09900: Painting - General
 - 2. Section 09960: Protective Coatings
 - 3. Section 10050: Building specialties

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Product Data; FIO

Fully describe all items proposed for use. Provide an actual photo or brochure photo of each type of sign.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with the following:
1. Americans with Disabilities Act (ADA).
 2. California Building Code, CCR T-24, especially Chapters 11A, 11C and 11D.
 3. California Code of Regulations, CCR Title 8, CAL/OSHA.
 4. Federal Occupational Safety and Health Act (OSHA): Referenced sections, specifications for accident prevention signs and tags and exit signs.
 5. Porcelain Enamel Institute Sign Division of the PEI:S-103, recommended standards for porcelain enamel signs.
- B. Comply with the manufacturer's published recommendation for installation of materials used.
- C. Comply with AFP (Air Force Pamphlet) 88-40 for signage location.

PART 2 PRODUCTS

2.1 SIGNS

- A. Architectural Handicap Access Signs:
1. Vomar Products, Inc.; PF 100 Series; Apco Graphics IM System; or equal.
 2. Sign characteristics:
 - a. Material: Integral color acrylic.
 - b. Frame and plaque in contrasting colors separated by a 1/16-inch reveal. Colors as selected from manufacturer's standard palette. Rectangular shape unless noted otherwise. Self-adhesive backing.
 - c. Text Helvetica Bold all caps: Size shown.
 - d. Sign size shall be as shown unless a larger size is required to accommodate lettering.
 3. Schedule of signs required:

<u>Quantity</u>	<u>Text</u>	<u>Text Height</u>	<u>Size in Inches</u>	<u>Comments</u>
1 each	MEN/WOMEN RESTROOM	3/4	As Required	Room identification sign. Mount on wall on latch side of door 60 inches above the floor. In conformance with CCR Title 24 1117B.5.9
1 each	MEN/WOMEN RESTROOM		12 inch triangle	Triangular shape inside circle with international unisex handicapped symbol Mount on door. In conformance with CCR Title 24 1115B.5

- B. Room Identifications Signs:
1. Vomar Products, Inc.; PF 100 Series; Apco Graphics IM System; or equal.

2. Sign characteristics:
 - a. Material: Integral color acrylic.
 - b. Frame and plaque in contrasting colors separated by a 1/16-inch reveal. Colors as selected from manufacturer's standard palette. Rectangular shape unless noted otherwise. Self-adhesive backing.
 - c. Text Helvetica Bold all caps: Size shown.
 - d. Sign size shall be as shown unless a larger size is required to accommodate lettering.
3. Mount sign 60 inches high above slab, on door.
4. Schedule of signs required:

<u>Quantity</u>	<u>Text</u>	<u>Location</u>	<u>Mounting Location</u>
2 each	SODIUM HYPOCHLORITE ROOM	Operations Building	Door No. 11 & 14
1 each	OPERATIONS ROOM	Operations Building	Door No. 17
2 each	ELECTRICAL ROOM	Operations Building	Door No. 13 & 19
1 each	FLUORIDE ROOM	Operations Building	Door No. 12

C. Fire Extinguisher Equipment Location Signs:

1. Comply with Federal and CAL OSHA.
2. Seton Nameplate Company; W.H. Brady Company; or equal.
3. Size: 4 inches wide by 18 inches (approximate size).
4. Material: Vinyl with adhesive back.
5. Text: Bright, fade-resistant red on white downward facing directional arrow on red field. Text is shown on schedule below.
6. Schedule of signs required:

<u>Quantity</u>	<u>Text</u>	<u>Seton</u>	<u>Brady or Equal</u>
One for each Fire Extinguisher. See Section 10050 - Building Specialties	"FIRE EXTINGUISHER"	FSM33	95343

D. Caution Signs:

1. Size: 14 inches wide by 10 inches high. For Sodium Bisulfite and Sodium Hypochlorite Signs use 14" x 14" size signs.
2. Material: Porcelain Enamel, 18-gauge
3. Text, format, and color:
 - a. Conforming to OSHA 1910.145(d)(4), Specifications for Caution Signs.
 - b. Text as scheduled below.
4. Provide eyelet holes at each corner for mounting.
5. Schedule of signs required:

<u>Quantity</u>	<u>Text</u>
3 each	CAUTION EYE PROTECTION AREA
8 each	CAUTION THIS EQUIPMENT STARTS AUTOMATICALLY

<u>Quantity</u>	<u>Text</u>
4 each	CAUTION (heading only, no printed message)
3 each	CAUTION WEAR EYE PROTECTION, RUBBER GLOVES AND APRONS WHEN HANDLING CHEMICALS
1 each	SODIUM HYPOCHLORITE - WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. CAUSES SUBSTANTIAL, BUT TEMPORARY EYE INJURY.
1 each	FLUOROSILISIC ACID - WARNING! HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE ALLERGIC RESPIRATORY REACTION. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. REACTS WITH ACIDS AND WATER RELEASING TOXIC SULFUR DIOXIDE GAS.

E. Informational Signs:

1. Size: 14 inches wide by 10 inches high.
2. Material: Porcelain Enamel, 18-gauge.
3. Text, format, and color:
 - a. Conforming to OSHA 1910.145 (d)(9), Specifications for Informational Signs.
 - b. Text as scheduled below.
4. Provide eyelet holes at each corner for mounting.
5. Where scheduled, provide AB Marine grade plywood backing and wood post, sealed and painted.
6. Schedule of signs required:

<u>Quantity</u>	<u>Text</u>
1 each	SODIUM HYPOCHLORITE FILL STATION
1 each	FLUOROSILISIC ACID FILL STATION
1 each	BRINE TANK FILL STATION
1 each	BRINE TANK

F. NFPA Fire Hazards of Materials Signs:

1. Seton Nameplate Company; W.H. Brady Company; or equal.
2. Sign characteristics: 4-color background, blue, red, yellow, white; diamond shape; 7-1/2 inches by 7-1/2 inches; 3-inch-high black hazard numerals scheduled below; conform to NFPA No. 704, System for identifying fire hazards of materials.
3. Material: Semi-rigid plastic with adhesive back.
4. Where mounted to concrete or other porous materials provide 3/4-inch-thick AB Marine grade Douglas Fir plywood backing, sealed edges, painted. Eyelet holes at corners for mounting.
5. Schedule of signs required:

<u>Quantity</u>	<u>Hazardous Material</u>	<u>Blue (Health)</u>	<u>Red (Fire)</u>	<u>Yellow (Reactivity)</u>	<u>White (Specific Hazard)</u>
2 each	Sodium Hypochlorite	3	0	1	ox
2 each	Fluorosilicic Acid	2	0	1	--

G. Chemical Signs:

1. Seton Nameplate Company; Style SCS; Legi-Sign; or equal.
2. Size: 10 inches wide by 14 inches high.
3. Material: Semi-rigid plastic with adhesive back.
4. Characteristics: Red text on white background. Text shall include chemical name, precautionary measures, signal word, statement of hazards, and antidote. Sign shall include NFPA No. 704, Hazard Identification System.
5. Where mounted to concrete or other porous materials, provide 3/4-inch-thick AB marine grade plywood backing, sealed edges, painted. Eyelet holes at corners for mounting.
6. Schedule of signs required:

<u>Quantity</u>	<u>Chemical Name</u>
2 each	Sodium Hypochlorite
1 each	Fluorosilicic Acid

2.2 TAGS

A. Accident Prevention Tags:

1. Seton Nameplate Company; W.H. Brady Company; or equal.
2. Size: Approximately 3 inches by 6 inches.
3. Material: Write-on matte finish plastic laminate, metal reinforced eyelet. Provide nylon or wire-tie fasteners.
4. Conform to OSHA 1910.145(F), Specifications for Accident Prevention Tags.
5. Text as scheduled below:

<u>Quantity</u>	<u>Text</u>
4 each	DANGER - DO NOT DRINK WATER
4 each	DANGER - DO NOT START
6 each	DANGER - DO NOT OPEN
6 each	DANGER - DO NOT CLOSE
2 each	CAUTION - IN USE (yellow colored tag)
4 each	DANGER - DO NOT OPERATE
4 each	OUT OF ORDER

PART 3 EXECUTION

3.1 SIGN INSTALLATION

- A. Install signs where directed by the Contracting Officer.
- B. Install signs after painting surfaces to receive signs. Follow manufacturer's written installation instructions.

C. Use fasteners as follows:

1. To concrete and masonry materials: 4-1/4-inches diameter expansion anchors.
2. To sheet metal (gauges 28 to 6) #10 sheet metal screws.
3. To gypsum board: Adhesive backing tape.
4. To chain link fencing: Wire ties at each corner.
5. To plywood backing boards: #10 wood screws.
6. To machinery: Fasteners as suitable.

D. Set sign posts in concrete.

3.2 TAGS

A. Do Not Drink Water Tags: Tie to faucets of non-potable water hose bibs as directed by Contracting Officer.

B. All Other Tags: Deliver to the Government in properly identified boxes or envelopes.

3.3 PIPE MARKERS

A. Pipe Markers shall be applied where piping enters or leaves the wall or floor of a structure, adjacent to tanks or other hydraulic containments, at each valve, at each piping change in direction, and shall be applied along piping runs not exceeding 16 feet on center.

B. Directional Arrows: Point in the direction of flow.

C. Locate pipe markers for easy reading. Where pipes are located above normal line of vision, the lettering and directional arrows shall be placed below the horizontal centerline of the pipe. Where pipes are below normal line of vision, lettering and directional arrows shall be above the horizontal centerline of the pipe.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 10 - SPECIALTIES

SECTION 10800

TOILET ACCESSORIES

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING
- 1.4 WARRANTY

PART 2 PRODUCTS

- 2.1 MANUFACTURED UNITS
 - 2.1.1 Anchors and Fasteners
 - 2.1.2 Finishes
- 2.2 ACCESSORY ITEMS
 - 2.2.1 Grab Bar (GB)
 - 2.2.2 Mirrors, Glass (MG)
 - 2.2.3 Sanitary Napkin Disposer (SND)
 - 2.2.4 Shower Curtain (SC)
 - 2.2.5 Shower Curtain Rods (SCR)
 - 2.2.6 Soap Dispenser (SD)
 - 2.2.7 Toilet Tissue Dispenser (TTD)
 - 2.2.8 Combination Paper Towel Dispenser/Waste Receptable Units (PTDWR) (WR)
 - 2.2.9 Toilet Seat Cover Dispenser (TSCD)

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 CLEANING

-- End of Section Table of Contents --

SECTION 10800

TOILET ACCESSORIES

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1036 (1991) Flat Glass

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-2380 (Rev A) Dispenser, Paper Towel

CID A-A-2398 (Rev B) Curtain, Shower and Window (Metric - SI)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Finishes; FIO. Accessory Items; FIO.

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, operation instructions, and cleaning instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area protected from construction damage and vandalism.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated in accordance with paragraph SCHEDULE. Each accessory item shall be complete with the necessary mounting plates and shall be of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall have oval heads and shall be finished to match the accessory.

2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

Metal	Finish
Stainless steel	No. 4 satin finish

2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

2.2.1 Grab Bar (GB)

Grab bar shall be 18 gauge, 1-1/4 inches OD Type 304 stainless steel. Grab bar shall be form and length as indicated. Exposed mounting flange shall have mounting holes concealed. Grab bar shall have satin finish. Installed bars shall be capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation. Space between wall and grab bar shall be 1-1/2 inch.

2.2.2 Mirrors, Glass (MG)

Glass for mirrors shall be Type I transparent flat type, Class 1-clear. Glazing Quality q1 1/4 inch thick conforming to ASTM C 1036. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint and shall be baked in uniform thickness to provide a protection for silver and

copper coatings which will permit normal cutting and edge fabrication.

2.2.3 Sanitary Napkin Disposer (SND)

Sanitary napkin disposal shall be constructed of Type 304 stainless steel with removable leak-proof receptacle for disposable liners. Fifty disposable liners of the type standard with the manufacturer shall be provided. Receptacle shall be retained in cabinet by tumbler lock. Disposer shall be provided with a door for inserting disposed napkins, and shall be surface mounted.

2.2.4 Shower Curtain (SC)

Shower curtain shall conform to CID A-A-2398, Style I, size to suit conditions. Curtain shall be anti-bacterial nylon/vinyl fabric. Color shall be white.

2.2.5 Shower Curtain Rods (SCR)

Shower curtain rods shall be Type 304 stainless steel 1-1/4 inch OD by 0.049 inch minimum straight to meet installation conditions.

2.2.6 Soap Dispenser (SD)

Soap dispenser shall be surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 40 fluid ounces with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.

2.2.7 Toilet Tissue Dispenser (TTD)

Toilet tissue holder shall be Type II - surface mounted with two rolls of standard tissue mounted horizontally. Cabinet shall be stainless steel, satin finish.

2.2.8 Combination Paper Towel Dispenser/Waste Receptacle Units (PTDWR) (WR)

Dispenser/receptacle shall be semi-recessed and shall have a capacity of 400 sheets of C-fold, single-fold, or quarter-fold towel. Waste receptacle shall be designed to be locked in unit and removable for service. Locking mechanism shall be tumbler key lock. Waste receptacle shall have a capacity of 12 gallons. Unit shall be fabricated of not less than 0.8 mm 0.30 inch stainless steel welded construction with all exposed surfaces having a satin finish. Waste receptacle that accepts reusable liner standard for unit manufacturer shall be provided.

2.2.9 Toilet Seat Cover Dispenser (TSCD)

Toilet seat cover dispensers shall be Type 304 stainless steel and shall be surface mounted. Dispenser shall have a minimum capacity of 500 seat covers.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet accessories shall be securely fastened to the supporting construction in accordance with the manufacturer's approved instructions. Accessories shall be protected from damage from the time of installation until acceptance.

3.2 CLEANING

Material shall be cleaned in accordance with manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring of surfaces.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 11 - EQUIPMENT

SECTION 11001

GENERAL EQUIPMENT AND MECHANICAL REQUIREMENTS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUMMARY
- 1.3 STANDARDS FOR THE WORK
- 1.4 SUBMITTALS
- 1.5 RESPONSIBILITY AND CARE OF EQUIPMENT

PART 2 PRODUCTS

- 2.1 DESIGN
- 2.2 MATERIALS AND STANDARD SPECIFICATIONS
- 2.3 LUBRICATION
- 2.4 STRUCTURAL METAL FRAMING
- 2.5 EQUIPMENT BASES AND BEDPLATES
- 2.6 ANCHORS
- 2.7 SAFETY GUARDS
- 2.8 LIFTING EYES
- 2.9 DRIVES
- 2.10 NAMEPLATES
- 2.11 PROTECTION AGAINST ELECTROLYSIS
- 2.12 SPECIAL TOOLS
- 2.13 FINISHES
- 2.14 NOISE AND VIBRATION
- 2.15 FACTORY TESTS

PART 3 EXECUTION

- 3.1 EXAMINATION
- 3.2 PREPARATION
- 3.3 INSTALLATION
- 3.4 EQUIPMENT STARTUP AND ADJUSTMENT
- 3.5 PERFORMANCE TESTS
- 3.6 SOUND LEVEL TESTING
- 3.7 TOOLS, LOOSE PARTS, AND LUBRICANTS
- 3.8 OPERATION AND MAINTENANCE MANUALS
- 3.9 CLEANING
- 3.10 GUARANTEE

-- End of Section Table of Contents --

SECTION 11001

GENERAL EQUIPMENT AND MECHANICAL REQUIREMENTS
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Gear Manufacturers Association (AGMA)

American Institute of Steel Construction (AISC)

California Code of Regulations, Title 8 Industrial Relations
(CAL/OSHA)

Hydraulic Institute

National Electrical Manufacturers Association (NEMA)

Occupational Safety and Health Act (OSHA)

1.2 SUMMARY

A. Section Includes: The general requirements for all of the Equipment and Mechanical work in the scope of the Project, included in Divisions 11, 12, 13, 14 and 15, and elsewhere wherever specifically mentioned in these Specifications.

B. Direct the attention of all subcontractors and suppliers of equipment and related appurtenances for the work to the applicable provisions in the Contract Documents wherever they may occur.

1.3 STANDARDS FOR THE WORK

A. Complete Systems: Provide pipe, fittings, wiring and supports to produce complete, operable systems with all elements properly interconnected. If a specific dimensioned location is not shown for interconnections or smaller system elements, select appropriate locations and show them on Shop Drawing submittals for review.

B. Provide equipment and material new and without imperfections. Erect in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work so that connecting and disconnecting of piping and

accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. Locate oil and lubrication fittings clear of and away from guards, base, and equipment and within reach from the operating floor. Coordinate location of all motor connections in order to properly orient encased electrical conduits.

C. The recommendations and instructions of the manufacturers of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Shop Drawings; GA.

Submit Shop Drawings and receive favorable review prior to fabrication, construction or delivery to the project site in accordance with Section 01300 of these Specifications. Show sizes and arrangement of equipment, foundations and anchor bolts required, performance characteristics, fan curves and pump curves, control diagrams, wiring diagrams, motor data sheets, methods of assembly, pipe hanging details, ductwork layouts and connections to other work. Date and sign drawings as certified for use in construction of this project. The arrangement of mechanical equipment and appurtenant piping shown on the Drawings may be varied as necessary to fit the favorably reviewed certified manufacturer's installation drawings. However, manufacturers' drawings shall not deviate in substance from the Contract Drawings and Specifications as to location, size, type and design of equipment.

The following minimum requirements shall accompany all equipment submissions:

1. Overall dimensions.
2. Mounting arrangement and dimensions.
3. Description of materials.
4. Connection sizes and orientation.
5. Capacity and location of lifting eyes.
6. Motor arrangement showing location of electrical connections.
7. Rating data - Mechanical and Electrical as applicable.
8. Detail electrical wiring diagrams, showing component designation and rating.
9. Seismic design certifications and anchorage descriptions.
10. Motor data as specified in Section 16415.
11. List of special tools and/or spare parts to be furnished, if any.

SD-08 Statements

Warranties and Guarantees; FIO

Submit a written warranty and guarantee on Contractor's letterhead restating the terms of the one-year warranty and guarantee on equipment.

SD-09 Reports

Performance Tests; FIO

Each piece of equipment, for which certified witnessed or non-witnessed performance tests are required, shall be accompanied by a completed form containing at least the following information:

1. Owner's name and location of project.
2. Contractor's name and subcontractor if applicable.
3. Name of item being submitted.
4. Specification reference by section, paragraph and page.
5. Data on item (manufacturer, general descriptive data, dimensions, size of connections, speeds, performance curves, serial number). A specific list of the test results plus a list which shows the values which differ from Specifications.
6. Motor data, type, voltage, frequency, phase, full load amperes, starting method, frame size, enclosure insulation type (NEMA Code letter), dimensions, service factor, serial number.
7. Date and signature of person certifying the performance.

SD-13 Certificates

Manufacturers' Affidavits; FIO

Manufacturers' Affidavits: Where called for in the Specifications, each equipment manufacturer, or his authorized representative, shall submit an affidavit.

SD-19 Operation and Maintenance Manuals

Instruction Manuals; FIO

Prepare and submit instruction manuals covering installation, operation and maintenance of all equipment and machinery specified in Divisions 11, 12, 13, 14 and 15.

1.5 RESPONSIBILITY AND CARE OF EQUIPMENT

A. The Contractor shall be responsible for the equipment included in this Contract until it has been finally inspected, tested and accepted in accordance with the requirements of these Specifications.

B. The Contractor shall make his own provisions for properly storing and protecting all material and equipment against theft, injury or damage from any and all causes. Damaged material and equipment shall not be used in the work.

PART 2 PRODUCTS

2.1 DESIGN

A. General: Design all equipment for the service intended, of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection and during continuous or intermittent operation. Adequately stay, brace and anchor, and install equipment in a neat and workmanlike manner. Give consideration to appearance and safety, as well as utility, in the design of details. Use cathodically compatible materials of construction.

B. Controls: Unless noted otherwise, the design of the electric control of any equipment system and/or equipment package shall be the responsibility of the manufacturer of the equipment system and/or equipment package. The elementary control diagrams as shown on the Electrical Drawings and the diagrams shown on the Instrumentation Drawings are illustrative of control and monitoring requirements pertaining to various equipment of this project. The manufacturers shall design their own functional electric control devices and circuitry, in consultation with the specific elementary control diagrams and other project specifications, to meet the equipment control requirements. All such systems and package controls shall be furnished by the equipment manufacturer, except that controls shown in motor control centers and process controllers, remote control devices, and their interconnecting wiring shall be provided under Divisions 13 and 16. Provide heating and ventilating controls, both 24-volt and line voltage type, by a HVAC controls specialist.

2.2 MATERIALS AND STANDARD SPECIFICATIONS

A. Materials: Design, fabricate and assemble equipment and systems with new materials and in accordance with acceptable modern engineering and shop practices. Manufacture individual parts to standard sizes and gauges so repair parts can be installed in the field.

B. Uniformity: Unless otherwise specified, equipment or material of the same type or classification used for the same purpose shall be the product of the same manufacturer and shall be the same model.

2.3 LUBRICATION

Provide lubricants of types recommended by equipment manufacturers, in quantities sufficient for consumption prior to completion, testing and final acceptance.

2.4 STRUCTURAL METAL FRAMING

A. Details of fabrication shall be in accordance with Section 05500.

2.5 EQUIPMENT BASES AND BEDPLATES

Mount equipment assemblies on a single heavy cast iron or welded steel bedplate unless otherwise shown or specified. Provide bases and bedplates with machined support pads, tapered dowels for alignment or mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. Round or chamfer and grind smooth all corners.

Continuously weld seams and contact edges between steel plates and shapes, and grind welds smooth. Do not support machinery or piping on bedplates other than that which is factory installed. Provide jacking screws in equipment bases and bedplates to aid in leveling prior to grouting. Mount all equipment bases and baseplates on reinforced concrete pads at least 3 inches high.

2.6 ANCHORS

A. Each equipment manufacturer shall furnish an anchor bolt pattern and the required anchor bolts, nuts and washers of adequate design for securing bases and bedplates to concrete bases. Provide anchor bolts of length to allow for 1-1/2-inch of grout under baseplates and adequate anchorage into structural concrete unless otherwise shown or specified.

B. Provide anchor and assembly bolts and nuts of ample size and strength for the purpose intended. All bolts shall be standard machine bolts, with cold pressed hexagon nuts. Provide suitable degauling compounds for bronze and stainless steel threaded components. Any space wholly or partially underground, or having a wall or ceiling forming part of a water channel, is classified as a moist location. Unless otherwise specified or noted on the Drawings, provide materials as follows:

1. Bolts and nuts in submerged locations or submerged and embedded in concrete or buried in earth: Type 304 stainless steel.
2. Bolts and nuts for supports or equipment in dry or moist locations: Galvanized steel (hot-dipped), with oversize nuts.
3. Use other bolting materials where specifically called for in the Specifications or on the Drawings.

C. Anchor all motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive. Do not provide expansion type anchors for motor-driven equipment.

D. Anchor all non-motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive except that, where specifically allowed by note on the Drawing, expansion type anchors may be used.

E. Refer to technical specification requirements of drilled-in anchors set in epoxy adhesive and for expansion bolt anchors.

2.7 SAFETY GUARDS

A. Cover belt or chain drives, fan blades, couplings, nip points, exposed shafts and other moving or rotating parts on all sides with safety guards conforming to all Federal, State, and local codes and regulations pertaining; conform to the most restrictive requirement. Design guards for easy installation and removal, complete with necessary supports, accessories, and fasteners, all hot-dip galvanized. Design guards in outdoor locations to prevent entrance of rain and dripping water. Provide tachometer test opening in line with ends of shafts. Typically guards shall be expanded metal on a structural steel frame except that outdoor guards may be of solid material. Provide hinged doors with latch for service and lubrication access.

B. Cover all pipes, manifolds, heaters, and other surfaces which have a surface temperature sufficient to burn human tissue with a thermal insulating material or otherwise guard against contact.

C. Guards to comply with CAL/OSHA 3940 through 3944.

2.8 LIFTING EYES

Supply all equipment weighing over 100 pounds with lifting eyes. Parts of equipment assemblies which are normally serviced separately, such as motors, to have lifting eyes of their own.

2.9 DRIVES

A. General: Provide all drive units with a American Gear Manufacturers Association (AGMA) rating and service factor suitable for 24 hours per day operation under the operating load.

B. Electric Motors: Conform to the requirements of Section 16415.

C. V-Belt Drives: Equip each V-belt drive with suitable tension adjustment. Provide drives having a service factor of at least 1.6 with arc length correction at maximum torque using nameplate rating of driving motor.

2.10 NAMEPLATES

A. Manufacturer's Nameplate: Furnish each piece of equipment and its driver with a corrosion-resistant metal nameplate fastened to the item in a readily readable position. This nameplate to contain the manufacturer's name, equipment rating, capacity, size, model, serial number and speed. All information written or printed to be in English.

B. Direction of Rotation: Furnish each piece of rotating equipment with a direction of rotation arrow.

C. Functional Identification: Label each piece of equipment using a plastic laminate label with the functional name and number of the equipment.

1. Fasten labels to the equipment, its base or other acceptable location:

- a. Letters: At least 1/2-inch high with the border trim on all sides not less than 1/4-inch.
- b. Color: Green background with white letters.
- c. Fasteners: Brass or stainless steel screwed into inserts, anchor shields or tapped holes in equipment or base.

2.11 PROTECTION AGAINST ELECTROLYSIS

Where dissimilar metals are used in conjunction with each other, provide suitable insulation between adjacent surfaces so as to eliminate direct contact and any resultant electrolysis. Connections of dissimilar piping materials shall utilize dielectric unions, flanges, couplings or bushings.

2.12 SPECIAL TOOLS

For each type of equipment to be furnished, provide a complete set of all special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation and maintenance of such equipment.

2.13 FINISHES

A. Conform to applicable requirements of Section 09900 and Section 09960.

B. Factory Painting: On pumps, motors, drives, starters, control panels and other similar self-contained or enclosed components, apply a factory protective paint system unless otherwise noted. Paint or otherwise protect surfaces that are inaccessible after assembly by a method which provides protection for the life of the equipment.

C. Shop Priming: Except where field sandblasting is required, apply one or more shop coats of metal primer on surfaces to be finish painted at the site, of sufficient thickness to protect surfaces until finished. Primer shall be compatible with finish coat.

D. Rust Preventive: Coat machined, polished, other ferrous surfaces, and non-ferrous surfaces which are not to be painted with rust preventive compound.

2.14 NOISE AND VIBRATION

A. Mechanical and electrical equipment, as installed in this project, shall not create sound levels that are in excess of that permitted by CAL/OSHA for 8 hours per day worker exposure unless otherwise noted for the specific piece of equipment involved. If the required sound level cannot be achieved by bare equipment in its designated environment, provide sound attenuating enclosures. Sound attenuating enclosures shall have necessary ventilation to prevent equipment overheating and shall be constructed for easy removal to permit maintenance. Devices necessary for day-to-day operation shall pierce the enclosure or otherwise be accessible without need to remove the enclosure.

B. Equipment which when operating has obvious excessive vibrations shall be repaired or replaced as directed by the Contracting Officer. Baseline vibration measurements shall be made where specified.

2.15 FACTORY TESTS

A. Perform factory tests for each piece of equipment where specifically called for in the section specifying that equipment. Note that factory tests are inherent in many reference standards. The requirement for a factory test in a referenced standard is hereby made a part of these Specifications. Conduct factory tests at the same speeds and other conditions at which the equipment will operate in the field, except as noted.

B. Where specifically noted, performance tests may be witnessed by the

Contracting Officer or his representative. Inform the Contracting Officer in sufficient time to allow arrangements to be made for witness of such tests. When non-witnessed tests are performed, supply certified results.

C. Perform factory testing of pumps in accordance with the requirements and standards of the Hydraulic Institute.

D. Tests of other equipment shall conform to the requirements set forth in these Specifications.

PART 3 EXECUTION

3.1 EXAMINATION

Inspect each item of equipment for damage, defects, completeness, and correct operation before installing.

3.2 PREPARATION

Prior to installing equipment, ensure that the areas are clean. Maintain the areas in a broom-clean condition during installation operations. Clean, condition, and service equipment in accordance with the approved Instruction Manuals and specific recommendations of the equipment manufacturer.

3.3 INSTALLATION

A. Structural Fabrications: Conform to the AISC Code and Specification referenced in Article "Structural Steel Fabrications."

B. Equipment: Conform to approved Instruction Manuals. Employ skilled craftsmen experienced in installation of the types of equipment specified. Use specialized tools and equipment, such as precision machinist levels, dial indicators, gauges, and micrometers, as applicable. Produce acceptable installations free of vibration or other defects. Align and pin to common bedplate equipment and drivers connected by flexible couplings.

C. Anchor Bolts: Deliver bolts with templates or setting drawings and verify that bolts are correctly located before structural concrete is placed.

D. Base and Bedplate Grouting: Do not place grout until initial fitting and alignment of connected piping is completed. Level and align equipment on the concrete foundations, then entirely fill the space under base or bedplates with grout. Bevel exposed grout at 45 degree angle, except round exposed grout at horizontal surfaces for drainage. Trowel or point exposed grout to a smooth, dense finish and damp cure with burlap for three days. When grout is fully hardened, remove jacking screws and tighten nuts on anchor bolts. Check the installation for alignment and level, and perform approved corrective work as required to conform to the tolerances given in the applicable Instruction Manual.

1. Make an allowance of at least 1-1/2 inches for grout under the equipment bases, whether or not shown on the Drawings. Use steel shims to level and adjust the bases. Shims may be left embedded in the

grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work. Unless otherwise approved, all grout shall be a favorably reviewed non-shrink, non-metallic grout.

2. Grout: Dimensionally stable, inorganic, premixed and resistant to acids, alkalies, and salt water, and unaffected by water and oil. It shall have high strength even when used as a pourable mixture, and shall bond well with steel and cured concrete or be compatible with a suitable bonding agent which shall then be used to effect the bond. Use in strict accordance with the manufacturer's recommendations.

Provide Five Star Grout as manufactured by U.S. Grout Corporation, Bonsal Construction Grout as manufactured by Bonsal Company, or equal.

3. Where practicable, place the grout through the grout holes in the equipment base and work outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.

E. Architectural Metals: Handrails, guardrails, stairs, and other architectural metals furnished as a part of equipment shall conform to the requirements of Section 05500.

3.4 EQUIPMENT STARTUP AND ADJUSTMENT

A. Arrange for an authorized factory-trained representative of the company or companies supplying the various items of equipment to check the installation and adjust and test the equipment furnished before the acceptance of the work by the Government. Said representative shall be experienced and knowledgeable of the equipment being tested. Furthermore, he shall assist and instruct the operating staff in adjusting and operating the equipment during the initial plant operation period.

1. Provide initial lubrication for all equipment.

2. Test and demonstrate to the Contracting Officer that all equipment operates properly and specified performance has been attained. For pumps, include measurement of suction and discharge pressure at the pump and measurement of pumping rate by volumetric means or through a suitably calibrated meter for two points on the performance curve. For adjustable-speed pumps, conduct tests at a minimum of two speeds. Furnish any test equipment or measuring devices required which are not part of the permanent installation.

3. In addition, demonstrate that the entire facility is in full operating condition prior to the acceptance of the work. Should any equipment or part thereof fail to operate as intended, immediately remove and replace it, all at the Contractor's expense. Pay for all tests involved in this Section.

4. Pressure test equipment and connections thereto as required by these Specifications.

3.5 PERFORMANCE TESTS

Upon completion of the work, and after all systems are set and balanced, conduct performance tests in accordance with applicable sections of these Specifications. Submit test conditions, test data and results to the Contracting Officer.

3.6 SOUND LEVEL TESTING

Measure the sound level developed by all mechanical and electrical equipment provided. Perform testing in all rooms and spaces containing such equipment during the final operation test program with all equipment operating. Use OSHA approved instrument and record the highest sound level developed when measured according to OSHA standards in each room and space. Deliver a copy of records to the Contracting Officer.

3.7 TOOLS, LOOSE PARTS, AND LUBRICANTS

A. Tools and Loose Parts Supplied: Provide an inventory of tools and loose parts required to be supplied under the project. Turn over inventory and parts to the Government. The Government's written acknowledgment of receipt is required for project completion. Loose parts are defined as items such as special tools, keys, safety equipment, and portable equipment. Refer to relevant technical sections of these Specifications for additional instructions.

B. Recommended Spare Parts: Furnish a complete list of recommended spare parts and supplies for each equipment furnished with current prices and a source of supply.

C. Provide a list of all recommended lubricants not listed in the O&M Manuals.

3.8 OPERATION AND MAINTENANCE MANUALS

Provide operation and maintenance manuals where specifically called for in the Specifications.

3.9 CLEANING

The Contractor shall keep the equipment and premises occupied by him in a neat and clean condition.

3.10 GUARANTEE

The Contractor shall guarantee equipment and performance of the installation and equipment.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 11 - EQUIPMENT

SECTION 11003

DISINFECTION

03/01

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS

PART 3 EXECUTION

- 3.1 SCHEDULING
- 3.2 PREPARATION
- 3.3 APPLICATION
- 3.4 FIELD QUALITY
- 3.5 DISPOSAL OF DISINFECTION SOLUTION
- 3.6 PROTECTION OF DISINFECTED STRUCTURES

-- End of Section Table of Contents --

SECTION 11003

DISINFECTION
03/01

PART 1 GENERAL

1.1 SUMMARY

A. Surfaces To Be Disinfected: Disinfect all inside surfaces with which water may come in contact in the following structures, pipelines, equipment and accessories:

1. Aerator
2. Aerated Water Sump
3. Filters
4. Backwash Tank
5. Large Pipelines:
 - a. Piping at and between aerator and filters.
 - b. Filtered water piping.
 - c. Backwash piping.
 - d. Service water piping.
 - e. Water distribution system piping disinfection is specified in Section 02510.
6. Small Pipelines:
 - a. Hot and cold domestic water piping.
 - b. Plant water.
6. Disposal of disinfection solution.
7. Bacteriological analyses of water.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Water Works Association (AWWA)

AWWA C651	AWWA Standard for Disinfecting Water Mains
AWWA C652	AWWA Standard for Disinfection of Water Storage Facilities

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Disinfection Plan; GA.

Submit a Disinfection Plan including the procedures, methods, materials and schedules proposed for disinfecting the required surfaces, and method of disposal of chlorinated water.

SD-09 Reports

Laboratory Testing; FIO.

A. Laboratory testing related to disinfection will be performed by and paid for by the Contractor. Costs of retests shall be paid for by the Contractor.

PART 2 PRODUCTS

2.1 MATERIALS

A. Water: Use plant water or system water as available.

PART 3 EXECUTION

3.1 SCHEDULING

A. Schedule and coordinate the work with operating personnel. Once disinfection has been satisfactorily accomplished, no further entry to the interior of the facilities will be allowed unless entry must be made to perform repairs, in which case repeat disinfection on a localized basis at no additional cost to the Government. The Contractor shall be responsible for maintaining security of the disinfected facilities.

B. Disinfect pipelines following successful pressure testing.

C. Conduct test for bacteriological analyses after successfully completing disinfection.

Note: Once the system has been satisfactorily disinfected, the system should not be depressurized.

3.2 PREPARATION

A. Provide all necessary appurtenances required for the disinfection procedures including taps, temporary piping, connections and shutoff valves.

B. The Contractor is advised that precautions taken to keep surfaces clean during construction and avoiding the entry of deleterious substances on the work during construction will facilitate achieving the disinfection requirements of this project.

C. Prior to disinfecting, thoroughly clean accessible surfaces of dust, dirt, foreign matter and deleterious substances remove any oil by contact with absorbents. Use water sprays, steam cleaning, vacuum cleaning, swabbing, hand brushing or a combination of methods and rinsing to effect

the cleaning, but do not use any method that will be detrimental to the finish surfaces. Flush inaccessible surfaces clean.

3.3 APPLICATION

A. After completing all construction activities, including painting and after allowing a minimum of ten days for the paint to cure, disinfect the required surfaces with chlorine solutions in accordance with the following procedures. Following disinfection and flushing, the Contracting Officer will take water samples for bacteriological analysis of the water. If the specified bacteriological requirements are not satisfied, repeat disinfection procedure until the requirements are met.

B. Water Storage Facilities (Aerated Water Sump):

1. Standard: AWWA C652 as amended herein.
2. Forms of Chlorine: Use sodium hypochlorite or calcium hypochlorite.
3. Method: 2 (Brush or Spray).

C. Filters:

1. Standard: AWWA C653 as amended herein.
2. Forms of Chlorine: Sodium hypochlorite or calcium hypochlorite.
3. Method:
 - a. Walls: Method 2 (brush or spray) as discussed in AWWA C652.
 - b. Media: Soak Method.

D. Large Pipelines:

1. Standard: AWWA C651.
2. Form of Chlorine: Sodium hypochlorite or calcium hypochlorite.
3. Method: Continuous feed.

E. Small Pipelines:

1. Preparation: Provide the system with a one-inch minimum service cock or valve or other means to inject chlorine solution at a point within two or three feet of its junction with the supply source. When system is complete thoroughly flush it by fully opening every outlet until clear water flows from all of them.
2. Disinfecting Agent: Sodium hypochlorite or calcium hypochlorite in sufficient quantities to produce chlorine concentration of at least 50 parts per million in the system.
3. Disinfecting Procedure:
 - a. Connect a hand-operated pump, or other means of injecting the disinfecting agent, to one-inch minimum service cock or valve or other injection device. Pump must provide a pressure greater than that of supply of system.
 - b. With system completely full of water and supply valve open, proceed to adjust every outlet of system so that a trickle of water flows from each.
 - c. Inject disinfectant slowly and continuously at an even rate, not in slugs, until a test at each outlet shows a free chlorine residual concentration of at least 50 parts per million.
 - d. Close all outlets and valves, including valve connecting to supply line and one-inch minimum service cock on solution injection connection. Maintain condition for 24 hours. After 24

hours test for residual chlorine at each outlet. The free residual chlorine concentration indicated should be not less than 10 ppm. If the indicated free chlorine concentration is less than 10 ppm, the disinfection procedure must be repeated until an approved result is obtained.

e. When the above procedure has been completed to the satisfaction of the Contracting Officer, flush out entire system with fresh water until tests at all outlets show a residual of not more than 0.5 ppm.

3.4 FIELD QUALITY

A. Chlorine Residual Testing: AWWA C651, Appendix A, DPD Drop Dilution Method, except where otherwise specified. Testing shall be performed by the Contractor.

B. Bacteriological Analyses of Water: After the completion of disinfecting procedure, including the final flushing as described in AWWA C651 and heretofore, the Contracting Officer will obtain water samples from this system for bacteriological analyses. Requirements for satisfactory disinfection of water supply are that bacteriological analyses indicate that water samples are negative for coliform organisms, and that Heterotrophic plate count (standard plate count) is less than 100 colony forming units per milliliter. If bacteriological analyses do not satisfy the above requirements, then repeat disinfection procedure until these requirements are met.

3.5 DISPOSAL OF DISINFECTION SOLUTION

A. Dechlorinate and dispose of water in accordance with applicable regulations.

3.6 PROTECTION OF DISINFECTED STRUCTURES

A. The Contractor shall exercise suitable precautions to protect disinfected facilities from contamination. If required to reopen or re-enter a disinfected pipeline or structure, the Contractor shall re-disinfect the facilities at no additional cost to the Government.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 11 - EQUIPMENT

SECTION 11215

VERTICAL TURBINE PUMPS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DESCRIPTION
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE

PART 2 PRODUCTS

- 2.1 VERTICAL TURBINE PUMPS
- 2.2 EQUIPMENT
- 2.3 ACCESSORIES
- 2.4 FINISHES

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 FIELD PAINTING
- 3.3 FIELD TESTING
- 3.4 FIELD SERVICE

-- End of Section Table of Contents --

SECTION 11215

VERTICAL TURBINE PUMPS

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

HYDRAULIC INSTITUTE

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA E101	Vertical Turbine Pumps - Line Shaft and Submersible Types
-----------	---

1.2 DESCRIPTION

A. Section Includes: Provide complete, tested and operating vertical turbine pumps as shown on the Drawings and as specified herein.

B. Related Sections:

1. Section 09960: Protective Coatings
2. Section 11001: General Equipment and Mechanical Requirements
3. Section 15200: Pipelines, Liquid Process Piping
4. Section 16261: Variable Frequency Drive Systems Under 600 Volts
5. Section 16415: Electrical Work, Interior (Motor)

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Shop Drawings and Product Data; GA.

Submit the following as a single complete initial submittal.

1. Product data to demonstrate that the equipment conforms to the Specifications.
2. Motor data.
3. Seismic anchorage certification and related sketch.
4. Pump layouts and dimensions.
5. Pump performance curves.

SD-09 Reports

Performance Testing; FIO.

Submit certified non-witnessed factory performance test results in accordance with the Hydraulic Institute. Receive favorable review of test results prior to shipping the equipment.

Field Test; FIO.

Submit field test report as required in paragraph 3.03

SD-13 Certificates

Affidavits; FIO.

Submit affidavit from the manufacturer stating that the equipment has been properly installed, adjusted, and tested and is ready for full time operation.

SD-19 Operation and Maintenance Manuals

Manuals; FIO.

Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.

1.4 QUALITY ASSURANCE

Equipment furnished under this Section shall be supplied by a single manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least five years. Demonstrate to the satisfaction of the Contracting Officer that the quality is equal to equipment made by those manufacturers named herein.

PART 2 PRODUCTS

2.1 VERTICAL TURBINE PUMPS

A. General: Furnish and install vertical turbine type pumps having the following hydraulic and electric characteristics:

B. Pump Schedule:

	Booster Pumps two (2) <u>and one (1) stand-by</u>
- Design Primary Operating Point	1,750 gpm @ 270 TDH ft
- Maximum Operating Point	2,000 gpm @ 225 TDH ± 5 ft
- Minimum Operating Point	1,300 gpm @ 318 TDH ± 5 ft

- Speed 1,770 rpm
- Motor Horsepower (Maximum) 150
- Guaranteed Minimum Bowl Efficiency @ Design Operating Point 82 percent
- Shutoff Head, Zero Flow 0 gpm @ 475 ft. max.
- Motor Data (rpm/phase/volts) 1770/3/460
- Submergence Over Lip of Bell 2 feet minimum
- Manufacturers Byron Jackson 15 "MQ"L", or equal

C. Pumps shall operate without excessive noise or vibration over the full operating range indicated in the Pump Schedule.

2.2 EQUIPMENT

A. Provide water lubricated vertical turbine pumps including bowl assembly, column, line shaft and guides, discharge head and electric motor. Comply with construction features of ANSI/AWWA E101 except where indicated differently in this Specification. Materials of construction shall be as listed in Table 1 of E101 except where indicated differently in this Specification.

B. Seismic: Entire pump and installation including motor, discharge head, anchors, column, drive shaft, pump bowls and impellers and fasteners shall comply with the seismic requirements.

C. Pump Construction:

1. Bowl assembly:

- a. Provide pump bowls of ductile iron, fired porcelain lined. Provide "O" ring seals.
- b. The impeller shaft shall be of Type 316 stainless steel and shall be supported by low zinc bronze and/or neoprene bearings. Bearings shall properly fit housing without knurling the housings or bearings. The first critical shaft speed shall be at least 125% of full operating speed.
- c. The impellers shall be of the enclosed type and shall be of bronze and of heavy construction, accurately fitted, statically and dynamically balanced to Hydraulic Institute Standards. The impellers shall be adjustable by means of a flanged spacer coupling assembly if hollow shaft motors are not furnished.
- d. Provide bronze wear rings on impellers and bowls.

2. Discharge column assembly:

- a. The total length of the discharge column shall be as required to meet the installation dimensions shown on the Drawings. Connect column pipes with threaded couplings.
- b. Open lineshaft pumps shall be water lubricated and shall have line shafting made of type 316 stainless steel.

- c. The line shaft bearings shall be bronze and/or neoprene.
- d. Column pipe shall be selected for a minimum operating pressure of 150 psi. The pipe shall be furnished in 10-foot maximum interchangeable sections.
- 3. Discharge Head: Fabricated steel or cast iron for mounting the motor and with discharge elbow having aboveground flanged end discharge outlet for connection to flanged pipe, as specified in Section 15200, PIPELINES, LIQUID PROCESS PIPING, and as shown on the Drawings. Provide direction of rotation arrow. Discharge heads on the pumps shall have 125 pound ANSI flanged outlets. Seals shall be selected by pump manufacturer for intended service. Maximum height of the discharge head shall be 24 inches.
- 4. All pump installations shall be provided with pressure taps, taps for ARV valve, and gauge cocks on the discharge side of the pump. Where such taps are not provided on the pump discharge head, they shall be provided on the piping immediately downstream of the pump. Taps or tees in piping shall be 3/4-inch size with reduction to 1/4-inch at gauge connection. Provide a discharge pressure gauge for each pump with features and accessories in accordance with Section 15200.
- 5. Approximate length from inlet bell to pump sump floor is 6 inches or as shown on the Drawings. Coordinate minimum distance with pump manufacturer.

D. Motors: Provide hollow shaft vertical motors for outdoor service, suitable for operation at 480 volts, and conforming to requirements of Section 16415. Nameplate motor horsepower shall not be exceeded at any flow up through the maximum operating point in the Pump Schedule. Provide thermal protection thermostats and space heater as required.

E. Data Plates: Mount a data plate on each pump unit. Data plates shall contain the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data. Provide additional nameplates and instrument tag numbers as shown on Drawings.

2.3 ACCESSORIES

A. Provide pressure taps, taps for ARV valve, and gauge cocks on the discharge side of all pump installations. Where such taps are not provided on the pump discharge head, they shall be provided on the piping immediately downstream of the pump. Taps or tees in piping shall be 3/4-inch size with reduction to 1/4-inch at gauge connection. Provide a discharge pressure gauge for pump with features and accessories in accordance with Section 15200.

B. Data Plates: Mount a data plate on each pump unit. Data plates shall contain the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data. Provide additional nameplates and instrument tag numbers as shown on Drawings.

C. Special Tools: Furnish a full set of manufacturer's special tools which are necessary for the replacement of parts and the adjustment of the equipment.

D. Provide type 316 stainless steel suction strainers with area at least four times the inlet eye. Provide cone strainers for the well pumps and basket strainers for the booster pumps.

2.4 FINISHES

A. Provide pumps, motors and bases with the manufacturer's standard factory-applied paint finish except as noted.

B. The columns, suction inlets, and outside of bowls shall be lined and coated with factory-applied System 3 specified in Section 09960. Provide appropriate returns to prevent lifting of the coatings by dynamic pressure. Protect the lining and coating against transportation damage.

C. Correct damage to the lining or coating to the satisfaction of the Contracting Officer if in his opinion it is repairable. Return equipment which has damaged coating and/or damaged lining, beyond repair, to the manufacturer for recoating.

PART 3 EXECUTION

3.1 INSTALLATION

Install the pump unit(s) in strict conformance with manufacturer's installation instructions. Check pump and motor alignment according to the Standards of the Hydraulic Institute after complete unit has been installed at the site.

3.2 FIELD PAINTING

Apply a final color coat of paint to the pump motor and discharge head in accordance with Section 09960.

3.3 FIELD TESTING

A. Perform field testing, observed by the Contracting Officer, to demonstrate that the installed pump systems provide the hydraulic performance determined by factory tests and that the equipment runs smoothly and is free from excessive noise and vibrations. Hydraulic Institute vibration limits shall govern.

B. Provide the following measurements to demonstrate field hydraulic capacity, the following measurements shall be made:

1. Distance between water surface and pumphead base flange
2. Discharge pressure
3. Motor current, all three phases
4. Motor voltage
5. Flow measured at finished water flow meter.
6. Vibration signature at upper motor bearing.
7. Verify wire-to-water efficiency.

C. Provide calibrated pressure gauges, clamp-on ammeter, and voltage meter for field measurements. Provide NETA certified personnel for

performing all field tests. Submit a written report to the Contracting Officer which compares field test results with Specification requirements and factory test results.

D. Pump units with field tests that fail to meet Specification conditions including guaranteed wire to water efficiencies shall be retested by the Contractor, after the problem is corrected, at the Contractor's expense using the procedures and instrumentation required by the Hydraulic Institute Standards. Pumps which fail to meet Specifications when tested by Hydraulic Institute Standards shall be repaired or replaced.

3.4 FIELD SERVICE

The equipment manufacturer shall supply a competent field service engineer to thoroughly check and inspect the equipment after installation, place the equipment in operation, make necessary adjustments, calibrate instruments, and conduct field tests.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 11 - EQUIPMENT

SECTION 11350

AERATOR

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DESCRIPTION
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
- 1.5 PERFORMANCE GUARANTEE

PART 2 PRODUCTS

- 2.1 FORCED DRAFT AERATOR

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 FIELD SERVICE
- 3.3 FIELD PAINTING

-- End of Section Table of Contents --

SECTION 11350

AERATOR
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

STANDARDS DEVELOPMENT ORGANIZATION (ACRONYM)

ACRONYM REF-ID	(issue/revision date) Publication Title
----------------	---

1.2 DESCRIPTION

- A. Requirements specified in Section 11001 form a part of this Section.
- B. Work included in this Section:
 - 1. Forced draft aerator
 - 2. Aerator media
 - 3. Blower

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Product Review Shop Drawings; GA.

Submit shop drawings for favorable review of the selected aerator system. The submittals shall contain sufficient data to show that the equipment conforms to the Specification requirements, including: sizes and location of equipment, materials of construction, and pertinent manufacturer's data.

Also, submit structural design calculations for the aerator assembly and supports to demonstrate that the unit conforms to the Seismic Anchorage of Equipment requirements.

SD-13 Certificates

Affidavits; FIO.

Furnish affidavits from the manufacturer stating that the complete aerator

system has been properly sized, installed and tested and is ready for full time operation.

SD-19 Operation and Maintenance Manuals

Manuals; FIO.

Furnish manufacturer's installation and operation and maintenance manuals, bulletins, and spare parts lists.

1.4 QUALITY ASSURANCE

- A. All equipment furnished under this Section shall:
1. be of a manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least five years; and
 2. be demonstrated to the satisfaction that the quality is equal to equipment made by those manufacturers specifically named herein.

1.5 PERFORMANCE GUARANTEE

Submit a performance guarantee from the aerator manufacturer stating that the aerator system will meet the performance test requirements of this Section for hydraulic capacity and noise limitation.

PART 2 PRODUCTS

2.1 FORCED DRAFT AERATOR

A. General: Furnish and install a complete forced draft aeration system capable of providing carbon dioxide, methane, and hydrogen sulfide reduction of 85 percent or more when treating raw water of the following general analysis (hydrogen sulfide reduction as a percentage of gaseous H₂S):

pH 7.7
Alkalinity 110 mg/l (as CaCO₃)
Total Hardness 140 mg/l (as CaCO₃)
Iron 0.30 mg/l
Manganese 0.28 mg/l
Hydrogen Sulfide 0.1 mg/l
Methane 2000 mg/l
CO₂ 2000 mg/L

The aerator system, including components such as piping, distributor, and underdrain, shall have hydraulic capacity to treat a design flow of 3,500 gpm.

- B. Aerator Construction:
1. Media: Loose fill, spherical shaped plastic media nominal 3½-inch diameter, over which water is distributed and allowed to fall into a sump area. Other media may be favorably reviewed by the Government if the media is demonstrated to improve the efficiency of gas exchange and flow distribution. Plastic shall be suitable for exposure to 5 mg/l

chlorinated water as well as the chemical and hydraulic loads listed above. Media shall be NSF approved. Manufacturer shall be Jaeger Products Tri-Pac Media, Norton equivalent, or equal.

2. Housing Assembly: The aerator housing shall be an aluminum closed chamber for effecting a counter current flow of water and air. Aluminum shall be a 3003 alloy or equal material suitable for potable water service. The aerator cover shall be fully removable. Three sides of the aerator shall be fixed. The fourth (east) side shall have a minimum of two access openings, with bolted, gasketed covers for access to the media. The minimum size of the top access opening shall be 3'-0" square. The bottom opening shall have a minimum height of 3 feet and shall be a 3 piece section covering the full aerator width. Provide handles on all opening covers. Depth of media shall be minimum 8 feet. Maximum chamber height shall be 15 feet (excluding exhaust vent).

The aerator chamber shall be suitably reinforced for seismic loads. In addition, the aerator structure and connections shall be designed to withstand all vibratory loads imposed. Aerator structure shall feature welded connections except as noted below.

3. Structural Design: Aerator structure shall be designed to provide internal support members for attachment (through shell) to pipe supports. Support system shall be designed to provide rigid support, without sag or deflection.

4. Distributors: A complete system of water distributors and noncorrosive air collectors shall be provided for uniform distribution of the inlet water over the horizontal cross-section of the aerator and for uniform collection of exhaust air. The water inlet distributor shall include an inlet water velocity breaker box and water distribution target nozzles. Distributor supports shall be designed to support the dead weight of the distributor system filled with water (i.e., all nozzles plugged). Distributor shall be continuously supported along the entire length of each side of the aerator structure. All distributor support connections shall be continuously welded or bolted. Tack or skip welded support connections will not be accepted.

5. Blower Assembly: Provide one motor driven blower of appropriate capacity and static pressure. Minimum blower capacity shall be 5 cfm/gpm at a discharge pressure of $\frac{3}{4}$ -inch S.P. The blower and motor shall be limited to be no greater than 7.5 HP. The blower rating shall be based on AMCA standards and shall bear the AMCA seal.

The blower motor shall be properly located for easy access and maintenance. Blower and motor shall be provided with a weather-proof enclosure and suitable supports for mounting directly to the aerated water sump top slab. Motor shall be provided with an explosion proof enclosure and a space heater for a thermostatically controlled 120-volt supply.

The maximum noise level of the blower/aerator assembly shall be limited to no more than 60 dBA when measured along the east fence line (approximately 150 feet). Provide stainless steel or fiberglass insect screen on air intake.

6. Air Exhaust: A properly sized exhaust air housing assembly shall be provided on top of the aerator chamber that allows the design air volume to pass through the unit without excessive headloss and with negligible noise. Provide a moisture eliminator in the discharge air

stream to eliminate the discharge of entrained moisture from the aerator. Provide stainless steel or fiberglass insect screen on outlet.

C. The Specifications and Drawings are based on preliminary submittals from anticipated aerator unit manufacturers. Any changes to the aerator or aerator support structure, including quantities, sizes or capacities, from those specified or shown on the Drawings shall be made by the Contractor without additional cost to the Government.

D. Manufacturers: U.S. Filter Co.; DeLoach Industries of Sarasota, Florida; or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Equipment shall be installed in strict conformance with the manufacturer's installation instructions.

B. Nameplates shall be provided as specified in Section 11001, GENERAL EQUIPMENT AND MECHANICAL REQUIREMENTS.

3.2 FIELD SERVICE

A. The aerator manufacturer shall inspect the installation and certify that the Contractor has installed the equipment in the correct manner.

B. The aerator manufacturer shall provide a trained field engineer to instruct operating personnel in the proper use and maintenance of the aerator unit.

3.3 FIELD PAINTING

All protective coating work accomplished in the field shall comply with Section 09960, PROTECTIVE COATINGS. The aluminum housings will not require painting.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 11 - EQUIPMENT

SECTION 11353

BRINE MAKE-UP SYSTEM

03/01

PART 1 GENERAL

- 1.1 DESCRIPTION
- 1.2 QUALITY ASSURANCE
- 1.3 SUBMITTALS
- 1.4 SEISMIC PROTECTION

PART 2 PRODUCTS

- 2.1 SATURATED BRINE TANK

PART 3 EXECUTION

- 3.1 SHIPPING
- 3.2 INSTALLATION
- 3.3 FIELD TEST
- 3.4 FIELD SERVICES

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 11353

BRINE MAKE-UP SYSTEM

03/01

PART 1 GENERAL

1.1 DESCRIPTION

Provide complete, tested and operating Brine Make-up System as shown on the Drawings and/or specified herein. The system shall consist of saturated brine tank, piping, controls and accessories as specified herein.

1.2 QUALITY ASSURANCE

- A. The product furnished under this Section shall:
1. Be of a single manufacturer who has been regularly engaged in the designed and manufacture of brine make-up system for at least five years.
 2. Be demonstrated to the satisfaction of the Government that the quality is equal to equipment made by those manufacturers specifically named herein.
- B. Manufacturer must be capable of providing the names and specific locations of customers for whom he has furnished brine make-up system that have been in service 5 years or more.
- C. Code Section with special application: Comply with the Uniform Fire Code, particularly Article 80, and the Uniform Building Code, particularly Chapter 9.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Chemical Resistance Data; FIO.

Provide data for chemical compatibility of the tank.

SD-04 Drawings

Shop Drawings; GA.

Submit shop drawings for favorable review of the brine make-up system. The

submittals shall contain sufficient data to show that the equipment conforms to the Specification requirements, including: sizes and location of all specified fittings and other appurtenances, materials of construction, and pertinent manufacturer's data. The submittal shall also include seismic calculations for the tank.

SD-13 Certificates

Affidavits; FIO.

Furnish affidavits from the manufacturer stating that the complete brine make-up system has been properly installed and tested and is ready for full time operation.

SD-19 Operation and Maintenance Manuals

Manuals; FIO.

Furnish manufacturer's installation and operation and maintenance manuals and spare parts lists.

1.4 SEISMIC PROTECTION

A. Tank specified herein requires seismic restraint.

PART 2 PRODUCTS

2.1 SATURATED BRINE TANK

A. Service Conditions: Provide tank suitable for outdoor service designed for 120°F maximum operating temperature, seismic conditions, superimposed mechanical load, and design capacity shall be based on a dry salt density of 68 lbs/cubic foot.

B. Minimum storage capacity shall be 30 tons. Maximum tank diameter is 10 feet and maximum tank height is 14 feet.

C. Tank shall be manufactured of high density crosslinked rotationally molded polyethylene and shall be suitable for the chemical concentrations listed. A 24-inch diameter manway and cover in the tank top shall be made of crosslinked polyethylene with one-half inch buttress threads (no metal). Other openings and fittings shall be provided as shown on the Drawings.

D. Resin used in the tank manufacture shall be crosslinkable polyethylene MARLEX CL200 as manufactured by Phillips Chemical, or equivalent. The rotationally molded tanks shall meet or exceed the following properties:

PARAMETER	ASTM TEST	QUANTITY
Density, gms/cc	D1505	0.938-0.941
Environmental stress cracking	D1693	>1000
Tensile strength, ultimate psi,	D638	2600

PARAMETER	ASTM TEST	QUANTITY
type IV specimen		
Elongation at break, %, type IV specimen	D638	450
Vicat softening point	D1525	~255°F
Brittleness temperature	D746	<-180°F

E. Impact test results must meet the requirements of 120 foot pounds at minus forty degrees Fahrenheit (-40°F). Test procedures to be equal to Phillips Chemical procedure described in bulletin TSM-291.

F. Wall thickness for a given hoop stress to be calculated by the Barlow formula. Provide wall thickness required by the Barlow formula. Design tank with a minimum hoop stress no greater than 600 psi and a safety factor of no less than 2 using the Barlow formula. Wall thickness calculations shall assume that all tanks contents have a specific gravity of not less than 1.5. Design tanks for higher specific gravities where noted in the tank schedule or the special requirements.

G. Manufacturer shall have the capability of issuing gel test results with 1/8" inner wall reading no less than 65% gel and outer wall no less than 90% gel. Entire thickness must be more than 80% gelled. procedure to run is described in Phillips Technical bulletin TSM-291.

H. Tank colors shall be natural unless specified otherwise.

I. Fittings:

1. PVC Fittings shall be compression type, long shank, deep cut thread (not injection molded) with dual wide nut. Fittings will be made vertical on sloping tank tops as indicated.
2. Chemical duty bolt shall use Hasteloy bolts with internal polypropylene injection molded encapsulated heads and CPVC external flanges.
3. Integrally Molded Flanged Outlets shall be molded as an original part of the tank.
4. Hasteloy and Stainless Steel (304 SS or 316 SS) fittings shall be compression type with external bolts and nuts.
5. Gaskets shall be crosslinked polyethylene closed cell foam material.
6. Flanges shall comply with ANSI B16.1.

J. Tank connections and accessories:

1. Salt Fill Line: 4" fully radiused 304SS with camlock and cap and 1" water spray connection for dust control.
2. Fill Line Support: 304SS.
3. Water Inlet Distributor: 1.5" 304SS.
4. Collection Plenum: 2" schedule 80 PVC/FRP filter / 304SS connection.
5. Drain: 1.5" 304SS with PVC ball valve.
6. Side Manway: 24" 304SS.
7. Level Control System: (2) Point Ultrasonic Level Control,

stilling well housing, electrically actuated ball valve.

8. Ladder with Operator Deck: Aluminum.

K. Seismic tank restraint: The restraint shall be built and installed in conformance with plans and instructions certified by a registered civil engineer. The lateral restraint system shall be designed for seismic zone 3, and shall conform to the Uniform Building Code.

L. Acceptable manufacturer: ClorTec/Brine Master, Wallace and Tiernan or equal.

PART 3 EXECUTION

3.1 SHIPPING

A. Ship tanks on padded saddles and tied down with padded slings.

3.2 INSTALLATION

A. Install the brine make-up system in strict conformance with the manufacturer's installation instructions and as shown on the Drawings.

B. System supplier technician or engineer that has been factory trained shall supervise the Contractor responsible for installation of a complete and operable system.

3.3 FIELD TEST

A. Test the tank after it is plumbed in by completely filling the tank with water. No leakage is allowed over a 48-hour minimum test period. If a leak is detected, the tank shall be replaced or repaired in a manner satisfactory to the Contracting Officer. Repairs shall only be performed by the tank manufacturer, at no additional cost to the Government. After repairs, retest the tank. Demonstrate that all tank accessories work properly.

B. After completing the static leak test, drain the water, and dry as required to leave the tank interior clean and ready for make-up and storage of brine. Then test the system to show conformance with these Specifications. Provide sufficient salt for the test.

3.4 FIELD SERVICES

A. Provide minimum eight (8) hours of onsite services by the manufacturer's factory-trained engineer or technician after the work is installed, cleaned, and tested.

B. Include the following services:

1. On-the-job training for Beale AFB Operations and Maintenance personnel.
2. Safety inspections and instruction.
3. Preventative maintenance instruction.
4. Calibration check and recalibration of instruments.
5. Shutdown instructions.

6. Startup and commissioning assistance and instruction.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 11 - EQUIPMENT

SECTION 11354

CHLORINE FEED SYSTEM

03/01

PART 1 GENERAL

- 1.1 DESCRIPTION
- 1.2 QUALITY ASSURANCE
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 METERING PUMP
- 2.2 METERING PUMP ACCESSORIES
- 2.3 CHEMICAL FEED SYSTEM ACCESSORIES

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 FIELD PAINTING/HARDWARE
- 3.3 FIELD TEST
- 3.4 FIELD SERVICES

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 11354

CHLORINE FEED SYSTEM

03/01

PART 1 GENERAL

1.1 DESCRIPTION

A. Furnish and install complete, tested and operating sodium hypochlorite feed systems as shown on the Drawings and as specified herein. The feed systems shall consist of, but not be limited to, feed pumps, piping, controls, and accessories as specified and as required:

1. Complete systems:

- a. Sodium Hypochlorite Feed System (quantity 1)

1.2 QUALITY ASSURANCE

A. All products furnished under this Section shall: (1) be of a single supplier who has been regularly engaged in the installation of the systems specified for at least 5 years; and (2) be demonstrated to the satisfaction that the quality is equal to equipment made by those manufacturers specifically named herein.

B. All components and equipment shall be suitable for the chemicals specified as follows:

1. In percentage by weight of solution:

- a. Sodium Hypochlorite 0.8%

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Shop Drawings; GA.

Submit shop drawings for favorable review of the chemical feed system. The submittals shall contain sufficient data to show that the equipment conforms to the Specification requirements.

SD-13 Certificates

Affidavits; FIO.

Furnish affidavits from the manufacturer stating that the chemical feed

system has been properly installed and tested and is ready for full time operation.

SD-19 Operation and Maintenance Manuals

Manuals; FIO.

Furnish manufacturer's installation and operation and maintenance manuals, bulletins, and spare parts lists.

PART 2 PRODUCTS

2.1 METERING PUMP

A. Type: Pump shall be mechanically actuated diaphragm-type, positive displacement. Pump shall have manual stroke control, and electronic speed control where indicated in the following schedule. Pump shall be Alldos Pump Series KM250 Model 255-332 (no equal) and shall match existing chlorine pump on site. Pump characteristics and ratings shall be as noted below:

Chemical Feed Metering Pump Schedule

Pump	Quantity of 1
Max. gph	105.1
Min. gph	30
Min. rated pressure (psig)	110
Max. rated pressure (psig)	145
Head Arrangement	Single
Voltage/phase/hp	230/3/1
Control	4 - 20 mA

B. Construction: Pump shall be designed to handle sodium hypochlorite. Pump shall be located as shown on the Drawings. Pump shall be a complete assembly including head, integral ball check valves, base and housing. The setting of the internal pressure relief valve shall be above the setting of the external pressure relief valve. Each pump shall be capable of continuous operation at zero stroke and flow. Each pump shall have an electric speed positioner with a minimum 10:1 range, with an indicator reading from 0 to 100 percent. The manual stroke positioner shall have a minimum 10:1 range and local position indicator. Pump construction shall be suitable for hypochlorite. The suction and discharge piping shall be of Schedule 80 PVC.

C. Flow Requirements: Pump capacity shall be as specified above. Ratings are specified at 100 percent stroke output. Pumps shall have a repeatability of one percent of full scale, given constant suction and discharge pressures.

2.2 METERING PUMP ACCESSORIES

A. Pressure Relief
Body: PVC
Diaphragm and Seat Gasket: Teflon

Setting: As required by pump manufacturer

- B. Pulsation Dampener
Material: PVC
Capacity: 120 cubic inches
Pressure Rating: 150 psi minimum
- C. Calibration Chamber
Capacity: 500 ml
Accessories: PVC ball valve and anti-splash cap
- D. Back Pressure Valve
Material: PVC
Pressure Rating: 170 psi at 120° F
- E. Injectors
Length: Extend into water line one-third the pipe diameter
Material: PVC
Accessories: Ball Check
- F. Provide charts showing the pump output for any stroke length setting over the entire pump speed range for metering pump.

2.3 CHEMICAL FEED SYSTEM ACCESSORIES

- A. General: Materials of construction shall be as specified herein and shall be satisfactory for continuous exposure to the hereinbefore listed chemicals.
- B. Calibration Chambers: Provide metering pump with a 500 ml calibration graduated cylinder furnished and installed and shown on the Drawings. Furnish cylinder assembly with ball valve or diaphragm valve as shown, nipple and plug for system operation without cylinder. Provide anti-splash cap.
- C. Accessories: Pulsation Dampeners and pressure relief valves shall be provided on the discharge of all metering pumps. Back pressure valves, anti-siphon valve, strainers and pressure gauges shall also be provided where shown on the Drawings. See Section 15200, for additional descriptions.
- D. Pressure relief, anti-siphon, and backpressure valves shall be of PVC body, hypalon faced with TFE diaphragm, Kynar stem and PVC seat. Pressure rating shall be 170 psi at 120 degrees F. The valves are to be field adjustable and installed as shown on the Drawings and/or recommended by the manufacturer. Valves shall be by Wallace & Tiernan, Pulsafeeder, or equal.
- E. Pressure gauge assemblies shall be as specified in Section 15200.
- F. Mounting Floor Bases: Factory furnished fiberglass mounting floor bases.

PART 3 EXECUTION

3.1 INSTALLATION

A. The chemical feed system shall be installed under the direction of the system supplier in strict conformance with the manufacturer's installation instructions.

3.2 FIELD PAINTING/HARDWARE

A. All sunlight-exposed PVC piping shall be painted with a high solids, water based paint. Tanks and chemical lines shall be labeled with appropriate names and directional arrows.

B. All fasteners and hardware shall be type 316 stainless steel or fiberglass.

3.3 FIELD TEST

A. Test the chemical feed system in all operational and alarm modes to show conformance with these specifications. Provide sufficient chemical (approximately 55 gallons), for the test.

B. The Contractor shall be responsible for the disposal of the test material. Prior to the final test, the chemical feed system shall be tested for four hours with water. After satisfactory testing with water the final test with actual chemical shall be provided.

C. Chemical pump shall be (chemical solution) calibrated and tested throughout their pumping range. System shall be tested against a closed discharge solution line to test pressure relief valve operation. This shall be performed and shall be witnessed by the Contracting Officer.

3.4 FIELD SERVICES

A. Provide an engineer or technician from the chemical feed system supplier to make all adjustments and to conduct the testing specified in Paragraph 3.3 above.

B. After successful completion of field testing, provide a minimum of 2-hours of training by an engineer or technician from the system supplier to train plant personnel in system operation, maintenance, and safety procedures.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 11 - EQUIPMENT

SECTION 11355

FLUORIDE FEED SYSTEM

03/01

PART 1 GENERAL

- 1.1 DESCRIPTION
- 1.2 QUALITY ASSURANCE
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 METERING PUMPS
- 2.2 METERING PUMP ACCESSORIES
- 2.3 CHEMICAL FEED SYSTEM ACCESSORIES

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 FIELD PAINTING/HARDWARE
- 3.3 FIELD TEST
- 3.4 FIELD SERVICES

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 11355

FLUORIDE FEED SYSTEM

03/01

PART 1 GENERAL

1.1 DESCRIPTION

A. Furnish and install complete, tested and operating fluoride feed systems as shown on the Drawings and as specified herein. The feed systems shall consist of, but not be limited to, feed pumps, piping, controls, tank (Section 13416) and accessories as specified and as required:

1. Complete systems:
 - a. Fluoride Feed System (quantity 2)

1.2 QUALITY ASSURANCE

A. All products furnished under this Section shall: (1) be of a single supplier who has been regularly engaged in the installation of the systems specified for at least 5 years; and (2) be demonstrated to the satisfaction that the quality is equal to equipment made by those manufacturers specifically named herein.

B. All components and equipment shall be suitable for the chemicals specified as follows:

1. In percentage by weight of solution:
 - a. Hydrofluosilicic Acid 23%

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Shop Drawings; GA.

Submit shop drawings for favorable review of the chemical feed system. The submittals shall contain sufficient data to show that the equipment conforms to the Specification requirements.

SD-13 Certificates

Affidavits; FIO.

Furnish affidavits from the manufacturer stating that the chemical feed

system has been properly installed and tested and is ready for full time operation.

SD-19 Operation and Maintenance Manuals

Manuals; FIO.

Furnish manufacturer's installation and operation and maintenance manuals, bulletins, and spare parts lists.

PART 2 PRODUCTS

2.1 METERING PUMPS

A. Type: Pumps shall be mechanically actuated diaphragm-type, positive displacement. All pumps shall have manual stroke control, and electronic speed control where indicated in the following schedule. Pumps shall be Pulsatron Series E Plus or equal. Pump characteristics and ratings shall be as noted below:

Chemical Feed Metering Pump Schedule

Pumps	Quantity of 2
Max. gpd	40
Min. gpd	10
Min. rated pressure (psig)	110
Max. rated pressure (psig)	250
Head Arrangement	Single
Voltage/phase	115/1
Control	4 - 20 mA

B. Construction: Pumps shall be designed to handle hydrofluosilicic acid. Pumps shall be located as shown on the Drawings. Each pump shall be a complete assembly including head, integral ball check valves, base and housing. The setting of the internal pressure relief valve shall be above the setting of the external pressure relief valve. Each pump shall be capable of continuous operation at zero stroke and flow. Each pump shall have an electric speed positioner with a minimum 10:1 range, with an indicator reading from 0 to 100 percent. The manual stroke positioner shall have a minimum 10:1 range and local position indicator. Pump construction shall be suitable for hydrofluosilicic acid. The suction and discharge piping shall be of Schedule 80 PVC.

C. Flow Requirements: Pump capacity shall be as specified above. Ratings are specified at 100 percent stroke output. Pumps shall have a repeatability of one percent of full scale, given constant suction and discharge pressures.

2.2 METERING PUMP ACCESSORIES

A. Pressure Relief
Body: PVC
Diaphragm and Seat Gasket: Teflon
Setting: As required by pump manufacturer

- B. Pulsation Dampener
Material: PVC
Capacity: 120 cubic inches
Pressure Rating: 150 psi minimum
- C. Calibration Chamber
Capacity: 500 ml
Accessories: PVC diaphragm valve and anti-splash cap
- D. Back Pressure Valve
Material: PVC
Pressure Rating: 170 psi at 120° F
- E. Injectors
Length: Extend into water line one-third the pipe diameter
Material: PVC
Accessories: Ball Check
- F. Provide charts showing the pump output for any stroke length setting over the entire pump speed range for all metering pumps.

2.3 CHEMICAL FEED SYSTEM ACCESSORIES

- A. General: Materials of construction shall be as specified herein and shall be satisfactory for continuous exposure to the hereinbefore listed chemicals.
- B. Calibration Chambers: Provide metering pump with a 500 ml calibration graduated cylinder furnished and installed and shown on the Drawings. Furnish cylinder assembly with diaphragm valve as shown, nipple and plug for system operation without cylinder. Provide anti-splash cap.
- C. Accessories: Back pressure valves, anti-siphon valve, strainers and pressure gauges shall also be provided where shown on the Drawings. See Section 15200, for additional descriptions.
- D. Anti-siphon, and backpressure valves shall be of PVC body, hypalon faced with TFE diaphragm, Kynar stem and PVC seat. Pressure rating shall be 170 psi at 120 degrees F. The valves are to be field adjustable and installed as shown on the Drawings and/or recommended by the manufacturer. Valves shall be by Wallace & Tiernan, Pulsafeeder, or equal.
- E. Pressure gauge assemblies shall be as specified in Section 15200.
- F. All buried fluoride piping shall be contained within a PVC Schedule 40 pipe for secondary containment. The doubly contained pipe shall be sloped in the direction of flow, without any traps, to the injection, or terminated in a box for visual observation of any leaks.
- G. Mounting Wall Brackets: Factory furnished fiberglass mounting wall brackets.

PART 3 EXECUTION

3.1 INSTALLATION

A. The chemical feed system shall be installed under the direction of the system supplier in strict conformance with the manufacturer's installation instructions.

3.2 FIELD PAINTING/HARDWARE

A. All sunlight-exposed PVC piping shall be painted with a high solids, water based paint. Tank and chemical lines shall be labeled with appropriate names and directional arrows.

B. All fasteners and hardware shall be type 316 stainless steel or fiberglass.

3.3 FIELD TEST

A. Test the chemical feed system in all operational and alarm modes to show conformance with these specifications. Provide sufficient chemical (approximately 55 gallons), for the test.

B. The Contractor shall be responsible for the disposal of the test material. Prior to the final test, the chemical feed system shall be tested for four hours with water. After satisfactory testing with water the final test with actual chemical shall be provided.

C. Chemical pumps shall be (chemical solution) calibrated and tested throughout their pumping range. System shall be tested against a closed discharge solution line to test pressure relief valve operation. This shall be performed for each pump and shall be witnessed by the Contracting Officer.

3.4 FIELD SERVICES

A. Provide an engineer or technician from the chemical feed system supplier to make all adjustments and to conduct the testing specified in Paragraph 3.3 above.

B. After successful completion of field testing, provide a minimum of 2-hours of training by an engineer or technician from the system supplier to train plant personnel in system operation, maintenance, and safety procedures.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 11 - EQUIPMENT

SECTION 11357

PRESSURE FILTERS

03/01

PART 1 GENERAL

- 1.1 DESCRIPTION
- 1.2 SUBMITTALS
- 1.3 QUALITY ASSURANCE
- 1.4 SEISMIC PROTECTION
- 1.5 SYSTEM RESPONSIBILITY
- 1.6 DESIGN REQUIREMENTS
- 1.7 PERFORMANCE GUARANTEE AND WARRANTY

PART 2 PRODUCTS

- 2.1 FILTERS
- 2.2 FILTER MEDIA
- 2.3 INTERCONNECTING PIPE, VALVES AND FIELD INSTRUMENTS
- 2.4 FILTER CONTROLS

PART 3 EXECUTION

- 3.1 INSTALLATION AND STARTUP
- 3.2 PERFORMANCE TESTING
- 3.3 TRAINING

-- End of Section Table of Contents --

SECTION 11357

PRESSURE FILTERS

03/01

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers the furnishing and installation of a fully automatic pressure type iron and manganese removal filtration system, complete and operable, as shown on the Drawings and as specified herein.

B. Work included in this Section:

1. Pressure filters, appurtenances and controls.
2. Filter media.
3. Filter piping and filter control valves.
4. Field instruments and piping appurtenances as specified.

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Hydraulic Calculations; FIO.

Submit hydraulic calculations of design pressure loss for clean filter bed and backwash conditions, and uniformity of flow for influent distributor/backwash collector and underdrain piping. Demonstrate conformance to the requirements of this Section. The calculations shall be based on the actual pipe sizes and configuration, orifice locations, filter media and support bed, and appurtenant piping to be supplied.

SD-04 Drawings

Shop Drawings; GA.

Submit shop drawings of the filters and appurtenances, filter media, interconnecting piping and appurtenances, field instruments, valve assemblies, and programmable logic controller. A single submittal shall be made, sufficient to depict the filtration systems as integrated, coordinated units, and shall contain sufficient data to show that all equipment conforms to the requirements of the Specifications. Submittals shall contain at least the following information: Flow diagram of systems showing sizes and relative locations of equipment for each site of work; control strategies; valve operation schedule; materials of construction;

pipng erection drawings showing pipe sizes and layout; wiring diagrams; and pertinent manufacturer's data on all components and instruments.

SD-09 Reports

Test Procedure; FIO.

Submit detailed step-by-step test procedures describing the methods, equipment, data collection, and method of chemical analysis to be used in the Performance Testing specified in Part 3 of this Section.

SD-13 Certificates

Affidavits; FIO.

Furnish an affidavit from the filter supplier, stating that the complete filtration system for that site has been properly installed, seismically restrained, adjusted and tested, and is ready for full time operation.

SD-14 Samples and SD-13 Certificates

Media Samples and Certification; GA.

Submit a sample of each size of gravel, anthracite, and silica sand to be supplied as filter media. With the samples, submit a certification from the source of supply for the media stating that the media conforms to the requirements of AWWA Specification B100. Samples and certification shall receive favorable review before media can be shipped to the jobsite.

SD-19 Operation and Maintenance Manuals

Manuals; FIO.

Furnish manufacturer's installation and operation and maintenance manuals, bulletins, and spare parts lists. Provide specific step-by-step instructions for operation of the filter system in all modes, and for extended-period shutdown and maintenance of any filter vessel or combination of vessels.

Provide performance guarantee per Para. 1.7.

1.3 QUALITY ASSURANCE

- A. All equipment furnished or modified under this Section shall:
 - 1. Be essentially the standard product of a manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least five years; and
 - 2. If equipment not specifically named herein is offered, be demonstrated to the satisfaction that the quality is equal to equipment made by those manufacturers specifically named herein.
- B. Filter supplier shall provide a list, complete with name of operator, phone number, and address, of at least five similar iron and manganese removal facilities that have been successfully removing iron and manganese

from municipal potable water for at least three years.

1.4 SEISMIC PROTECTION

All piping and equipment specified in this Section requires seismic restraint.

1.5 SYSTEM RESPONSIBILITY

A. One supplier shall be responsible for furnishing, coordinating assembly and installation, testing, and starting up the pressure filtration systems. This responsibility shall include the pressure vessels and internals, filter media, filter piping and valves (limited as shown on the Drawings), field instrumentation (limited as shown on the Drawings), accessories, and miscellaneous controls as shown on the Drawings. The filter supplier is not responsible for the chlorination/fluoridation system instrumentation and equipment specified under Section 11354 and 11355.

B. The filter system supplier may not delegate testing and start-up requirements to the General Contractor or other party.

1.6 DESIGN REQUIREMENTS

The pressure filter equipment shall be designed for the following requirements:

- A. Design rate of flow per vessel: 1,167 gpm
- B. Hydraulic loading rate at design flow: <7 gpm/sq. ft.
- C. Normal maximum operating pressure: 150 psig
- D. Influent water quality ranges:
 - 1. Iron: 0.02 - 0.90 mg/L
 - 2. Manganese: 0.01 - 1.1 mg/L
 - 3. pH: 7.3 - 7.8
 - 4. Alkalinity: 75 - 200 mg/L as CaCO₃
 - 5. Temperature: 55 - 70°F
 - 6. Total dissolved solids: 150 - 300 mg/L
 - 7. Color: negligible

The raw well water will be pretreated for oxidation of iron and manganese by forced-draft aeration and chlorination with a minimum of five minutes contact time, then pumped to the filters for removal of precipitates of iron and manganese oxides through filtration or adsorption/oxidation.

E. In general, piping sizes are shown on the drawings or P&IDs. In the event pipe sizes are not shown, or there is a conflict, the following internal pipe size shall be:

- 1. Filter inlet/backwash outlet: 12 inches
- 2. Filter outlet/backwash inlet: 12 inches
- 3. Surface Wash: 6 inches

Filter piping manifold sizes shall be as shown on sheet M4.0.

1.7 PERFORMANCE GUARANTEE AND WARRANTY

A. Performance guarantee: The filter manufacturer shall review the filter influent raw water quality as stated in Paragraph 1.6 and the other requirements of these Specifications, and shall guarantee that the filter equipment supplied will consistently produce filtered water having iron and manganese concentrations and operational characteristics as noted below:

1. Iron concentration in filter effluent: < 0.05 mg average;
0.10 mg/L maximum
2. Manganese concentration in filter effluent: < 0.02 mg/L average;
0.04 mg/L maximum
3. Filter clogging rate: < 0.5 ft/hr at 4 gpm/SF
4. Backwash water consumption: < 3% of throughput volume

Submit a performance guarantee from the filter manufacturer stating that the pressure filter systems will meet the performance requirements stated.

B. Warranty: The filter supplier shall provide a written warranty for the satisfactory performance of the filter system for two years following system testing and placement in operation. In the event that the filtration process does not meet the treated water iron and manganese concentration limits or operational requirements as specified in sub-para. A. above, or if there is a difficulty or failure in controls or equipment, the filter supplier will be notified by telephone and must provide advice on corrective action within 24 hours. If the performance or operation condition deficiency continues for more than 3 days, a representative of the filter supplier shall come to the site and correct the condition to the satisfaction of the Government.

PART 2 PRODUCTS

2.1 FILTERS

A. Provide one complete pressure filter system, as shown on the Drawings and as specified herein, to remove iron and manganese to the levels specified in Paragraph 1.7. Each filter system shall be complete with pressure vessels and internals, filter media, control and manual valves, field instruments, interconnecting piping and fittings, and other items as specified in this Section. Filter system shall be as supplied by Rescue Engineers, Loprest, or equal.

B. Filter system characteristics shall be as follows:

1. Filter type shall be horizontal single cell unit.
2. Media shall be 18 inches of silica sand and 12 inches of anthracite, with graded gravel support.
3. Three identical filter vessels shall be supplied.
4. Each filter vessel shall be nominal 8-foot diameter with straight shell length nominal 24 feet, and shall provide a minimum 192 square feet filtration area.
5. Backwash shall be capable at a rate of 15 - 20 gpm/SF. Actual backwash rate of each filter vessel shall be adjustable by motor-operated valve on the backwash discharge pipe. Backwash rate control valve shall be furnished by the filter manufacturer. A minimum of 30 percent increase in media volume shall be possible during backwashing before the media reaches the invert of the inlet/backwash outlet header.
6. Surface wash shall be capable at a minimum rate of 2 gpm/SF

concurrent with backwash.

7. During filter operation, maximum pressure drop from the inlet header connection to the filtered water connection to the distribution system shall not exceed 3 pounds per square inch differential (psid) under clean filter bed conditions, or 15 psid prior to backwash.

C. Pressure Vessels and supports:

1. The vessels shall be designed, constructed, welded and pressure tested in accordance with Section VIII, Division 1 of the ASME Code and shall bear the ASME Code stamp. The design pressure shall be 150 psig.

Materials of construction shall be ASTM A285 Grade C, ASTM A515, or ASTM A516 carbon steel. An alternative grade of steel may be used if favorably reviewed prior to release for fabrication. The vessels shall have standard dished heads. All vessel piping connections shall be Schedule 40 carbon steel with 150-lb fittings. Provide four structural steel lifting lugs per vessel, welded to the top centerline of the vessel shell.

2. Each filter vessel shall be supported by two structural steel support saddles welded to the shell. Seismic loads shall be carried to the concrete foundation pads shown on the Drawings through foundation anchor bolts sized by the tank designer. Provide at least six bolts per support as part of the scope of supply of the filter systems.

3. Ship the vessels fully finish painted on the interior, and shop primed and ready for field painting on the exterior.

D. Filter Internals:

1. Each vessel shall have individual inlet/backwash outlet pipe, and an individual surface wash inlet.

2. The inlet/backwash outlet piping shall extend the entire length of the filter and be designed to provide even distribution of flow throughout the filter. The distribution system shall be a perforated header, with orifices staggered 45 degrees along the upper vertical centerline of the header pipe. Material of construction shall be minimum Schedule 20 304 SS.

3. The backwash distributor/effluent collection piping shall be the header lateral type. The distributors shall be arranged for uniform collection of effluent and uniform distribution of backwash water, and shall not exceed 8 feet of water head loss when backwashing at the rate of 15 gpm/SF. Uniform distribution shall be defined as a flow rate variation of no more than +/- 5%. Header shall be minimum Schedule 20 304 SS with Schedule 80 PVC laterals. Laterals shall be drilled-orifice type.

4. Surface wash piping for the filter shall be provided with laterals and fixed nozzles to evenly distribute surface wash water throughout the expanded media at a location close to the top of the unexpanded media bed. As an alternative to fixed laterals and nozzles, rotating surface wash agitators may be used. Surface wash piping inside the filter vessel shall be minimum Schedule 20 304 SS.

E. Filter Vessel appurtenances: Equip each filter vessel with the following appurtenances:

1. Three (3) 24-inch blind flanged nozzles as upper manholes, allowing access to each filter. Provide a permanent davit assembly for each nozzle allowing removal and replacement of the blind flange.

2. Three (3) 12-inch x 16-inch (minimum) elliptical lower manholes, allowing access to the filter.
3. Two (2) 2-inch combination air/vacuum valves as specified in Section 15200, each installed with an isolation valve in a 1" threaded penetration on the top centerline of the vessel.

2.2 FILTER MEDIA

A. The filter supplier shall provide sufficient silica sand and anthracite filter media for initial startup and operation of the filters, and shall furnish an additional 10 percent of the calculated nominal required volumes for future use by the Government. Spare media shall be shipped double-bagged in one cubic foot sealed bags on pallets with the each bag plainly marked as to its contents. All filter media and graded gravel support materials shall be the product of a company experienced in the production of media for water treatment filtration use. Filter media materials, testing, shipment, placement and preparation of filter for service shall conform to AWWA B100-89 except as specifically modified herein.

B. Anthracite shall be No. 1 grade, MOH hardness greater than 3.0, effective size 0.70 - 0.80 mm, uniformity coefficient 1.40 - 1.60, meeting the requirements of AWWA B100. Not more than 20 percent of the total weight or number of particles shall be thin or flat as defined by one dimension exceeding 3 times any other dimension by number or weight proportion.

C. Silica sand shall be well-graded and generally spherical, less than 2.0 mm in diameter, with an effective size of 0.45 - 0.55 mm and a uniformity coefficient of 1.45 - 1.65, conforming to the requirements of AWWA B100.

D. The gravel support bed shall be 15 inches in depth and shall consist of five sizes of gravel, ranging in size from 3/4" - 1-1/2" at the bottom to 6 x 12 mesh at the top. The gravel shall be clean, carefully graded and free from lime and iron, and shall meet the requirements of AWWA B100. Grading of the gravel layers shall be designed to disperse the backwash water uniformly across the entire filter cell area without channeling or excessive flows along the vessel walls.

2.3 INTERCONNECTING PIPE, VALVES AND FIELD INSTRUMENTS

A. As part of the scope of supply of the filter systems, provide prefabricated and match-marked interconnecting piping assemblies and pipe supports with control valves, isolation valves, pressure gauges, flow meters, and other appurtenances and field instruments as shown on the Drawings and as specified herein. Pipe shall be Type N-1 or M-2 as scheduled and specified in 15200. The Contractor shall coordinate the installation of connecting piping with the favorably reviewed filter piping drawings.

B. Filter valves shall be butterfly valves as specified in Section 15200. Manual valves shall have gear or lever operators as specified in Section 15200 for the applicable size range. Control valves shall have electric

operators, as specified in Section 15200.

C. Pressure gauges, differential pressure transmitters, and pressure transmitters shall be as specified in Division 13.

D. Flow meters shall be as specified in Division 13.

E. Provide a backwash water sight glass on the backwash piping.

2.4 FILTER CONTROLS

The filters shall be controlled by a programmable logic controller (PLC). The PLC shall be as specified in Division 13.

PART 3 EXECUTION

3.1 INSTALLATION AND STARTUP

A. Field service: The filter supplier's field engineer shall be available on call during the installation of the filter systems, and shall review the installation instructions with the Contracting Officer and Contractor on-site and train the Contractor's personnel in cautionary procedures critical to proper installation. The filter supplier's field engineer shall be present during placement of concrete fill in the vessels, installation of filter internal piping and internal components, testing of underdrain piping for clogging, placement of gravel support and filter media, initial washing of media, and shall place the completed filter system in service. In addition, the filter supplier's field engineer shall conduct the performance testing and train the Beale's operations personnel as specified herein. THE REQUIREMENTS OF THIS SECTION WILL NOT BE WAIVED OR DILUTED.

B. Underdrain installation: After the filter vessels are set in place and the underdrain laterals or collection nozzles have been installed, vacuum clean the underdrain area, all piping, and all surfaces that come into contact with the backwash supply water. This cleaning must be favorably reviewed prior to placement of gravel support material.

C. Field paint touch-up of filter internals: After placement of concrete, prior to placing gravel support material, inspect the interior of each vessel and touch up any marred or scratched coating. Refer to Section 09960 for other requirements for field painting.

3.2 PERFORMANCE TESTING

A. The filter supplier shall start up the filters, make necessary adjustments, and demonstrate to the Government that the complete filter system is in proper operating condition. Demonstrate proper operation by operating the system continuously for a period of not less than one week (5 full days). Accomplish at least two backwash events during this period under program control, one of which shall be induced by simulating a high headloss condition.

B. Once a week over a period of a month, the filter supplier shall

collect the water samples and analyze the influent and effluent iron and manganese levels as the silica sand media develops a manganese dioxide coating. The Contractor will be allowed to alter, adjust, add, or replace system components as necessary to meet the performance requirements provided that these requirements are met prior to the contract completion date.

3.3 TRAINING

During the performance testing period, the filter supplier shall conduct training sessions for the Beale's operating personnel in the theory, function, operation, and maintenance of the filter system and PLC, and regarding PLC controls provided for equipment other than the filters. As part of the scope of supply for the filter system, provide the services of the filter supplier's field engineer during the summer of the first year following startup of the filter system, to inspect the system operation and to provide an 8-hour on-site operation and maintenance refresher training session for the Beale's operations personnel. Submit a report of the field trip to the Government for information, pointing out any deficiencies and offering recommendations on maintenance activities, as appropriate.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 12 - FURNISHINGS

SECTION 12320

CABINETS AND COUNTERTOPS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DESIGN
- 1.3 LAMINATED PLASTIC COUNTERTOPS AND ACID RESISTANT LAMINATED PLASTIC
LABORATORY COUNTERTOPS
- 1.4 SUBMITTALS
- 1.5 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 CABINETS
 - 2.1.1 Frame Type Cabinets
- 2.2 WOOD MATERIALS
- 2.3 PLASTIC LAMINATE
- 2.4 NON-WOOD MATERIALS
- 2.5 CABINETWORK HARDWARE
- 2.6 FINISH
 - 2.6.1 Cabinet Finish
 - 2.6.2 Backer Sheets
- 2.7 COLOR, TEXTURE, AND PATTERN

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 INSTALLING PLASTIC LAMINATE WORK
- 3.3 CLEANING

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 12320

CABINETS AND COUNTERTOPS

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (1995) High-Pressure Decorative Laminates

1.2 DESIGN

A. Cabinets shall be wood, factory-fabricated and finished in the manufacturer's standard sizes and finishes of the type, design, and configuration indicated. Cabinets shall be constructed as specified and shall meet the requirements of WIC Custom Grade. Wall and base cabinet assemblies shall consist of individual units joined into continuous sections. Fastenings shall be accomplished to permit removal and replacement of individual units without affecting the remainder of the installation. Counters shall be provided with watertight sink rim when indicated. Drawers shall be removable and shall be equipped with position stops to avoid accidental complete withdrawals. Shelves shall be fixed or adjustable as indicated.

B. Plastic Covered Cabinetwork:

1. Quality: WIC Premium Grade: Fabricate cabinetwork in accordance with WIC Manual, Section 15; Style "A" Frameless, flush overlay, square flush overlay doors, Type II construction. All Exposed Casework material shall be High Pressure Laminate. Glue all plastic face sheets backing sheets and edgebanding to core material with Type II adhesive in a hot plate veneer press except that edgebanding may be done under clamped pressure.
2. Cabinet doors and drawer fronts shall be medium density particleboard or MDF with High Pressure Laminate both faces and High Pressure Laminate edgebanding, WIC Type A.
3. Semi-exposed portions shall be covered with High Pressure Laminate cabinet Liner.

C. Assemble at mill insofar as practicable. Deliver to job ready for erection. Make ample allowance for cutting, when necessary to scribe and fit on job. Work in accordance with measurements taken at job. Join work with concealed nails and screws, and with glued joints and glue blocks.

D. Exposed Surfaces: Machine-sanded or scraped to even, smooth surface, ready for finish. Hand-sand field joints to same condition.

E. Make cabinets with top open web frame to receive Plastic Laminated Corian countertops.

1.3 LAMINATED PLASTIC COUNTERTOPS AND ACID RESISTANT LAMINATED PLASTIC LABORATORY COUNTERTOPS

A. WIC Premium Grade and Laboratory Grade complying with the requirements of the WIC Manual of Millwork for both manufacture and installation:

1. Laminated plastic countertops and backsplashes: WIC Premium Grade Section 16.
2. Acid Resistant Laminated Plastic Laboratory Countertops and Backsplashes: WIC Laboratory Grade Section 17.
3. Installation: WIC Premium and Laboratory Grade Section 26.

B. Use laboratory grade, standard or postforming type Plastic Laminate as required. Apply Plastic Laminate top sheets, backing sheets and edgebanding to core using Type II urea glue in a hot plate veneer press except that edgebanding may be done under clamped pressure. Core shall be closed grain hardwood faced marine grade plywood.

C. Apply 0.028-inch minimum thickness NEMA LD backing sheets to all work.

D. Provide 1/4-inch radius coved backsplash. Top laminated plastic sheets shall overlap self edge sheets on all tops. Seal edges of core at all cutouts with two coats of marine varnish.

E. Use of contact cement not permitted except for field installation of top self-edge at end splash when top fits between two walls.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Cabinets; FIO

Countertops and Backsplash; FIO

Manufacturer's printed data, catalog cuts, installation and cleaning instructions.

SD-04 Drawings

Installation; FIO

Drawings showing each type of cabinet and related item, and clearly

indicating the complete plan, location, and elevations of the cabinets and accessories and pertinent details of construction, fabrication, and attachments.

SD-09 Reports

Cabinets and Countertops; FIO

Certify that all cabinets comply with the requirements of WIC Custom Grade Cabinets.

SD-14 Samples

Cabinets; FIO

Countertops and Backsplash; FIO

In lieu of individual samples, complete minimum size cabinets may be furnished as samples. Mock-up units are not acceptable. Samples shall be of sufficient size to show color, pattern, and method of assembly.

- a. Countertop color samples approximately 2 x 3 inches size.

1.5 DELIVERY AND STORAGE

Cabinets shall be delivered to the jobsite wrapped in a protective covering. Cabinets shall be stored in accordance with manufacturer's recommendations in an adequately ventilated, dry location that is free of dust, water, or other contaminants and in a manner to permit access for inspection and handling. Cabinets shall be handled carefully to prevent damage to the surfaces. Damaged items that cannot be restored to like-new condition shall be replaced.

PART 2 PRODUCTS

2.1 CABINETS

Wall and base cabinets shall be of the same construction and same outside appearance. Door design shall be solid flush face from vendors standard styles. Shelves shall be fully adjustable. Adjustable shelves shall be capable of adjusting on approximately 3 inch increments. Shelves shall be supported by self-locking clips or wood dowels. Dowels shall be approximately 5/16 inch in diameter by 1-9/16 inches long. Dowels shall be inserted into borings for the shelf adjustments. Shelves shall be minimum 1/2 inch thick plywood or minimum 1/2 inch thick 45 pound density particle board. Drawer fronts shall be 45 pound density particle board or hardwood plywood.

2.1.1 Frame Type Cabinets

The cabinets shall be constructed with frame fronts and solid ends, or frame construction throughout. Frame members shall be 3/4 inch thick by 1-1/2 inch wide; kiln-dried hardwood, glued together, and shall be either mortised and tenoned, dovetailed or doweled, nailed, stapled or screwed. Top and bottom corners shall be braced with either hardwood blocks that are

glued together with water resistant glue and nailed in place, or metal or plastic corner braces. Backs of wall cabinets shall be 1/8 inch thick plywood, 3/8 inch thick, 45 pound density particle board. Backs of base and tall cabinets shall be 3/8 inch thick hardwood or 3/8 inch thick, or 45 pound density particle board. Bottoms of cabinets shall be minimum 3/8 inch thick plywood 45 pound density particle board or good grade plywood and shall be braced with wood members glued in place. Cabinet ends shall be 5/8 inch thick hardwood plywood or 5/8 inch thick, 45 pound density particle board core.

2.2 WOOD MATERIALS

- A. All material kiln dried to 8% moisture content for interior material; 12% for exterior material. Comply with Woodwork Institute of California (WIC) grading rules, Custom grade unless a higher grade is indicated.
- B. Softwood Lumber: WIC grade and species required by wood species, grade of product and type of finish specified or shown.
- C. Hardwood and Softwood Plywood: WIC grade and species required by wood species, grade of product and type of finish specified or shown.
- D. Particleboard: A mat-formed flat panel consisting of wood particles bonded together with a synthetic resin, compressed to proper density and heat cured. Meets ANSI A208.1-87 Table 1, Grade 1-M-3, medium density 40 to 50 lbs. per cubic foot.
- E. Medium Density: Fiberboard (MDF): A dry formed panel made from lignocellulosic combined with a synthetic resin, compressed to a density of 31 to 50 lbs. per cubic foot in a process which creates a complete bonding of all fibers. Meets ANSI A208.2-1980 with a density of 31 to 50 lbs. per cubic foot.

2.3 PLASTIC LAMINATE

- A. Plastic Laminate: Decorative, high-pressure laminate standard type, NEMA GP50, 0.048-inch-thick, postforming type, NEMA PF42, 0.038-inch thick and vertical surface type, NEMA GP28, 0.028-inch thick, and conforming to NEMA Publication LD3; satin or suede finish; solid color or pattern selected from manufacturer's standard palette. FORMICA, Formica Corporation; WilsonArt; or equal.
- B. Laboratory Grade Acid Resistant Plastic Laminate: Decorative, high-pressure laminate, laboratory type, postforming grade, 0.038-inch thick. NEMA PF42. Formica Chemical/Stain Resistant Laboratory Postforming Grade 840/LGP (white color only), or equal.

2.4 NON-WOOD MATERIALS

- A. Bolts and Screws: Hex head machine bolts, carriage bolts with hex nuts, hex head lag screws and wood screws, provide cut washers unless malleable washers indicated. Use hot dipped galvanized fasteners for all exterior locations; electro-galvanized for interior use.

B. Nails: Common, box, casing or finish, sizes as shown or as required. Exterior fasteners hot dipped galvanized.

C. Expansion Anchor Bolts and Drive Anchors for Attaching Items to Concrete or Masonry:

1. Adhesive Capsule Anchors: Shall be steel, Molly Parabond capsule anchors, by the Molly Division of the Emhart Fastener Group; HVA adhesive anchors by Hilti Fastening Systems; or equal. Use adhesive capsule anchors in exterior locations only.
2. Expansion Anchor Bolts: Shall be steel machine bolts with steel expansion shields and may require a larger embedment hole than the nominal bolt size. Minimum bolt size 1/2-inch diameter. Minimum embedment in concrete or masonry 3 inches. Do not load in excess of 1/4 of certified test value for static loads or 1/10 of test values for vibratory (machinery) loads and seismic loads. HILTI HSL Heavy Duty Anchor; RAWL-Bolt; or equal. Use where noted and for:
 - a. Loads of 1,000 pounds or over.
 - b. To attach all machines and devices with moving parts.
 - c. For all loads in tension or withdrawal.
3. Wedge Anchor Bolts: Special steel machine bolts with built-in expanding wedge and requiring a hole in the concrete the same size as the nominal bolt size. Minimum size: 3/8-inch-diameter by 3-inch embedment in concrete or masonry. Do not load in excess of 1/4 of certified test value. Phillips Red Head Wedge Anchors WS series; Wej-it expansion bolts; or equal. Use where noted and for:
 - a. Loads less than 1,000 pounds.
 - b. Loads in shear only.
 - c. DO NOT USE to attach machinery or resist vibratory loads.
4. Drive-Anchors: One piece deformed spring steel anchor: Rawl-Drives; equivalent Buildex; or equal.

D. Adhesives:

1. Construction Adhesive: Polyurethane type by 3M, U.S. Plywood; or equal.
2. Panel Adhesive: Latex type by U.S. Plywood; DAP; or equal.
3. Woodworkers Glue: Aliphatic type yellow glue, Borden's; Franklin; or equal.
4. Type II Water Resistant Adhesive that will retain almost all of its strength when occasionally subjected to a thorough wetting and drying. Shall withstand the three-cycle cold soak test specified in ANSI/HPMA HP 1983.

E. Water Repellent Preservative: Clear water repellent preservative containing pentachlorophenol, Woodlife; Pentaseal; or equal.

F. Sealant: One part polyurethane, same as sealant "B" in Section 07900: Vulkem #116; Sikaflex 1a; or equal.

2.5 CABINETWORK HARDWARE

A. Finish for All Casework Hardware: Satin Stainless Steel

B. Adjustable shelf supports, chrome-plated steel recessed standards and supports, Knappe and Voght #255 Standards, #256 supports; Garvey K-73

Standards, T-73 supports; or equal.

C. Drawer Slides: Side mounting, zinc-plated, cold-rolled steel, 1/2-inch side clearance, full extension (less than 100% extension not acceptable), 50-pound capacity for 4-inch-high drawers, 100-pound capacity for larger drawers, combination nylon rollers and steel ball bearings, Knappe & Voght #1428 for 50 pounds and #1429 for 100 pounds; or equal.

D. Door and Drawer Pulls: Solid brass wire type, finish to match Finish Hardware specified in Section 08700: 5/16-inch diameter, 3-1/2-inch long, 1-5/16-inch projection: Stanley 4483-1/2 x 10B; or equal.

E. Hinges: Pivot type for 1-1/8- to 1-3/8-inch-thick flush overlay doors, 0.134-inch-thick steel with plated finish: Stanley No. 340 or No. 342 as required for application; or equal.

F. Hinges: Concealed Hinges for overlayed construction of type required for each application: Blum Modul 90 series; Gersheson; or equal.

2.6 FINISH

2.6.1 Cabinet Finish

Cabinets shall be provided with a factory-applied durable finish in accordance with WIC Custom Grade requirements. Exposed exterior surfaces shall be plastic laminate.

2.6.2 Backer Sheets

Backer Sheets of high pressure plastic laminate, shall conform to NEMA LD 3, Grade BK20 and shall be applied to the underside of all core material.

2.7 COLOR, TEXTURE, AND PATTERN

Design, color, and finish shall be selected from manufacturer's standard and as specified in Section 09915 COLOR SCHEDULE.

PART 3 EXECUTION

3.1 INSTALLATION

Cabinets shall be installed level, plumb, and true to line, and shall be attached to the walls or floors with suitable devices to securely anchor each unit. Countertops, accessories, and hardware shall be installed as indicated on the drawings. Installation shall be in accordance with the manufacturer's approved printed instructions. The inner edge of sink cut-outs in laminated plastic tops shall be painted with a coat of semigloss enamel paint and sink flanges shall be set in a bed of sealant. Closer and filler strips and finish moldings shall be provided as required. Prior to final acceptance, doors shall be aligned, and hardware shall be adjusted.

3.2 INSTALLING PLASTIC LAMINATE WORK

A. Field fit and scribe plastic countertops to job conditions after cabinets have been properly installed. Attach countertops to cabinets with wood screws through cabinet top web frame into bottom of countertop.

3.3 CLEANING

Cabinet and countertop surfaces shall be cleaned in accordance with manufacturer's instructions.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13080

SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 General Requirements
- 1.3 SUBMITTALS
- 1.4 EQUIPMENT REQUIREMENTS
 - 1.4.1 Rigidly Mounted Equipment

PART 2 PRODUCTS

- 2.1 BOLTS AND NUTS
- 2.2 SWAY BRACING

PART 3 EXECUTION

- 3.1 BRACING
- 3.2 BUILDING DRIFT
- 3.3 ANCHOR BOLTS
 - 3.3.1 Cast-In-Place
 - 3.3.2 Expansion or Chemically Bonded Anchors
 - 3.3.2.1 General Testing
 - 3.3.2.2 Torque Wrench Testing
 - 3.3.2.3 Pullout Testing
- 3.4 RESILIENT VIBRATION ISOLATION DEVICES
 - 3.4.1 Resilient and Spring-Type Vibration Devices
 - 3.4.2 Multidirectional Seismic Snubbers
- 3.5 SWAY BRACES FOR PIPING
 - 3.5.1 Longitudinal Sway Bracing
 - 3.5.2 Anchor Rods, Angles, and Bars
 - 3.5.3 Maximum Length for Anchor Braces
 - 3.5.4 Bolts
- 3.6 EQUIPMENT SWAY BRACING
 - 3.6.1 Suspended Equipment and Light Fixtures
 - 3.6.2 Floor or Pad Mounted Equipment
 - 3.6.2.1 Shear Resistance
 - 3.6.2.2 Overturning Resistance

-- End of Section Table of Contents --

SECTION 13080

SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997a) Carbon Structural Steel
ASTM A 53	(1999) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 153/A 153M	(1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(1997) Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM A 325	(1997) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 325M	(1997) High-Strength Bolts for Structural Steel Joints (Metric)
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 563	(1997) Carbon and Alloy Steel Nuts
ASTM A 572/A 572M	(1999) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 603	(1998) Zinc-Coated Steel Structural Wire Rope
ASTM A 653/A 653M	(1999) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM E 488	(1996) Strength of Anchors in Concrete and

Masonry Elements

ASME INTERNATIONAL(ASME)

- ASME B18.2.1 (1996) Square and Hex Bolts and Screws
(Inch Series)
- ASME B18.2.2 (1987; R 1999) Square and Hex Nuts (Inch
Series)

CORPS OF ENGINEERS, HUNTSVILLE CENTER (CEHNC)

- TI 809-04 (1998) Seismic Design for Buildings

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

The requirements for seismic protection measures described in this section shall be applied to the mechanical equipment and systems outlined in Section 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT, the electrical equipment and systems outlined in Section 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT, and the miscellaneous equipment and systems listed below. Seismic protection requirements shall be in accordance with TI 809-04 and additional data furnished by the Contracting Officer, and shall be provided in addition to any other requirements called for in other sections of these specifications. The design for seismic protection shall be based on a Seismic Use Group II building occupancy and on site response coefficients for $S_{MS} = 0.15$ and $S_{M1} = 0.04$. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads. The basic force formulas, for Ground Motions A and B in Chapter 3 of TI 809-04, use the design spectral response acceleration parameters for the performance objective of the building, not for equipment in the building; therefore, corresponding adjustments to the formulas shall be required.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Bracing; FIO. Equipment Requirements; FIO.

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

SD-04 Drawings

Bracing; FIO. Equipment Requirements; FIO.

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction. For equipment and systems in buildings that have a performance objective higher than life-safety, the drawings shall be stamped by the registered engineer who stamps the calculations required above.

1.4 EQUIPMENT REQUIREMENTS

1.4.1 Rigidly Mounted Equipment

The following specific items of equipment to be furnished under this contract shall be constructed and assembled to withstand the seismic forces specified in TI 809-04, Chapter 10. For any rigid equipment which is rigidly attached on both sides of a building expansion joint, flexible joints for piping, electrical conduit, etc., that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions, shall be provided.

Tank
Generator
Transformer
Equipment inside and outside the Operations Building

PART 2 PRODUCTS

2.1 BOLTS AND NUTS

Squarehead and hexhead bolts, and heavy hexagon nuts, ASME B18.2.1, ASME B18.2.2, or ASTM A 307 for bolts and ASTM A 563 for nuts. Bolts and nuts used underground and/or exposed to weather shall be galvanized in accordance with ASTM A 153/A 153M.

2.2 SWAY BRACING

Material used for members listed in this section, shall be structural steel conforming with the following:

- a. Plates, rods, and rolled shapes, ASTM A 36/A 36M. If the Contractor does the design, both ASTM A 36/A 36M and ASTM A 572/A 572M, grade 503 will be allowed.
- b. Wire rope, ASTM A 603.
- c. Tubes, ASTM A 500, Grade B.
- d. Pipes, ASTM A 53, Type E, Grade B.
- e. Light gauge angles, less than 1/4 inch thickness, ASTM A 653/A 653M.

PART 3 EXECUTION

3.1 BRACING

Bracing shall conform to the arrangements shown. Trapeze-type hanger shall be secured with not less than two 1/2 inch bolts.

3.2 BUILDING DRIFT

Sway braces for a piping run shall not be attached to two dissimilar structural elements of a building that may respond differentially during an earthquake unless a flexible joint is provided.

3.3 ANCHOR BOLTS

3.3.1 Cast-In-Place

Floor or pad mounted equipment shall use cast-in-place anchor bolts, except as specified below. One nut shall be provided on each bolt. Anchor bolts shall conform to ASTM A 307. Anchor bolts shall have an embedded straight length equal to at least 12 times nominal diameter of the bolt. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

3.3.2 Expansion or Chemically Bonded Anchors

Expansion or chemically bonded anchors shall not be used unless test data in accordance with ASTM E 488 has been provided to verify the adequacy of the specific anchor and application. Expansion or chemically bonded anchors shall not be used to resist pull-out in overhead and wall installations if the adhesive is manufactured with temperature sensitive epoxies and the location is accessible to a building fire. Expansion and chemically bonded anchors shall be installed in accordance with the manufacturer's recommendations. The allowable forces shall be adjusted for the spacing between anchor bolts and the distance between the anchor bolt and the nearest edge, as specified by the manufacturer.

3.3.2.1 General Testing

Expansion and chemically bonded anchors shall be tested in place after installation. The tests shall occur not more than 24 hours after installation of the anchor and shall be conducted by an independent testing agency; testing shall be performed on random anchor bolts as described below.

3.3.2.2 Torque Wrench Testing

Torque wrench testing shall be done on not less than 50 percent of the total installed expansion anchors and at least one anchor for every piece of equipment containing more than two anchors. The test torque shall equal the minimum required installation torque as required by the bolt

manufacturer. Torque wrenches shall be calibrated at the beginning of each day the torque tests are performed. Torque wrenches shall be recalibrated for each bolt diameter whenever tests are run on bolts of various diameters. The applied torque shall be between 20 and 100 percent of wrench capacity. The test torque shall be reached within one half turn of the nut, except for 3/8 inch sleeve anchors which shall reach their torque by one quarter turn of the nut. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified torque; if the anchor still fails the test it shall be replaced.

3.3.2.3 Pullout Testing

Expansion and chemically bonded anchors shall be tested by applying a pullout load using a hydraulic ram attached to the anchor bolt. At least 5 percent of the anchors, but not less than 3 per day shall be tested. The load shall be applied to the anchor without removing the nut; when that is not possible, the nut shall be removed and a threaded coupler shall be installed of the same tightness as the original nut. The test setup shall be checked to verify that the anchor is not restrained from withdrawing by the baseplate, the test fixture, or any other fixtures. The support for the testing apparatus shall be at least 1.5 times the embedment length away from the bolt being tested. Each tested anchor shall be loaded to 1 times the design tension value for the anchor. The anchor shall have no observable movement at the test load. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified load; if the anchor still fails the test it shall be replaced.

3.4 RESILIENT VIBRATION ISOLATION DEVICES

Where the need for these devices is determined, based on the magnitude of the design seismic forces, selection of anchor bolts for vibration isolation devices and/or snubbers for equipment base and foundations shall follow the same procedure as in paragraph ANCHOR BOLTS, except that an equipment weight equal to five times the actual equipment weight shall be used.

3.4.1 Resilient and Spring-Type Vibration Devices

Vibration isolation devices shall be selected so that the maximum movement of equipment from the static deflection point shall be 0.5 inches.

3.4.2 Multidirectional Seismic Snubbers

Multidirectional seismic snubbers employing elastomeric pads shall be installed on floor- or slab-mounted equipment. These snubbers shall provide 0.25 inches free vertical and horizontal movement from the static deflection point. Snubber medium shall consist of multiple pads of cotton duct and neoprene or other suitable materials arranged around a flanged steel trunnion so both horizontal and vertical forces are resisted by the snubber medium.

3.5 SWAY BRACES FOR PIPING

Transverse sway bracing for steel and copper pipe shall be provided at intervals not to exceed those shown on the drawings. Transverse sway bracing for pipes of materials other than steel and copper shall be provided at intervals not to exceed the hanger spacing as specified in Section 15400 PLUMBING, GENERAL PURPOSE. Bracing shall consist of at least one vertical angle 2 x 2 x 16 gauge and one diagonal angle of the same size.

3.5.1 Longitudinal Sway Bracing

Longitudinal sway bracing shall be provided in accordance with Section 15070 SEISMIC CONTROL FOR MECHANICAL EQUIPMENT.

3.5.2 Anchor Rods, Angles, and Bars

Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in the tabulation below.

3.5.3 Maximum Length for Anchor Braces

Type	Size (Inches)	Maximum Length* (Feet/Inches)
Angles	1-1/2 x 1-1/2 x 1/4	4-10
	2 x 2 x 1/4	6-6
	2-1/2 x 1-1/2 x 1/4	8-0
	3 x 2-1/2 x 1/4	8-10
	3 x 3 x 1/4	9-10
Rods	3/4	3-1
	7/8	3-8
Flat Bars	1-1/2 x 1/4	1-2
	2 x 1/4	1-2
	2 x 3/8	1-9
Pipes (40S)	1	7-0
	1-1/4	9-0
	1-1/2	10-4
	2	13-1

3.5.4 Bolts

Bolts used for attachment of anchors to pipe and structure shall be not less than 1/2 inch diameter.

3.6 EQUIPMENT SWAY BRACING

3.6.1 Suspended Equipment and Light Fixtures

Equipment sway bracing shall be provided for items supported from overhead floor or roof structural systems, including light fixtures. Braces shall consist of angles, rods, wire rope, bars, or pipes arranged as shown and secured at both ends with not less than 1/2 inch bolts. Sufficient braces shall be provided for equipment to resist a horizontal force equal to 2 times the weight of equipment without exceeding safe working stress of bracing components. Details of equipment bracing shall be submitted for acceptance. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

3.6.2 Floor or Pad Mounted Equipment

3.6.2.1 Shear Resistance

Floor mounted equipment shall be bolted to the floor. Requirements for the number and installation of bolts to resist shear forces shall be in accordance with paragraph ANCHOR BOLTS.

3.6.2.2 Overturning Resistance

The ratio of the overturning moment from seismic forces to the resisting moment due to gravity loads shall be used to determine if overturning forces need to be considered in the sizing of anchor bolts. Calculations shall be provided to verify the adequacy of the anchor bolts for combined shear and overturning.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13202

ABOVEGROUND FUEL TANK

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DESCRIPTION
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
- 1.5 DELIVERY, STORAGE AND HANDLING
- 1.6 WARRANTY

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
- 2.2 FUEL TANK
- 2.3 ACCESSORIES
- 2.4 PRODUCT PIPING

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 FIELD QUALITY CONTROL

-- End of Section Table of Contents --

SECTION 13202

ABOVEGROUND FUEL TANK
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

UNDERWRITER LABORATORIES (UL)

UL 142 Standard Specification for Steel Tank Construction

UL 1709 Rapid Rise Fire Curve

UL 2085 Outline of Investigation for Insulated Aboveground Tanks for Flammable and Combustible Liquids

UNIFORM FIRE CODE (UFC)

A-II-F-1 (Formerly 79-7) Testing Requirements for Protected Motor Vehicle Fuel Storage Tanks

Other applicable sections

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30 (1996; Errata TIA 96-2) Flammable and Combustible Liquids Codes

1.2 DESCRIPTION

A. Section Includes: Furnishing and installing complete, tested, and operable double wall fuel tank and accessories as shown on the Drawings and as specified herein. The fuel tank shall be furnished as a complete, factory prefabricated unit.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Shop Drawings; FIO.

Submit shop drawings showing the layout and accessory locations, seismic anchorage certification and related sketch.

SD-13 Certificates

Affidavits; FIO.

Furnish affidavits from the manufacturer stating that the equipment has been properly installed and tested and is ready for full time operation.

Compliance and Standards; FIO.

Furnish certification of UL listings, UFC and NFPA standards, and compliance with specified performance.

SD-19 Operation and Maintenance Manuals

Manuals; FIO.

Furnish manufacturer's installation and operation and maintenance instructions.

1.4 QUALITY ASSURANCE

A. Qualifications: Equipment furnished under this Section shall be supplied by a manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years.

B. Regulatory Requirements:

1. Uniform Building Code
2. Uniform Fire Code,
3. Beale AFB Fire Department

1.5 DELIVERY, STORAGE AND HANDLING

A. Use non-marring slings for loading, unloading and handling units to prevent rope or cable damage to surfaces and protective wrappings.

1.6 WARRANTY

A. The aboveground fuel storage tank shall be warranted by the manufacturer for a period of 30 years from the date it is put in service. The warranty shall cover tank replacement in the event of a tank failure occurring under normal working conditions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fuel tank shall be as manufactured by B.R.E. Products, Inc.

Enviro-Vault, EV Series; Trusco Tank FL Series 'SUPERVAULT'; or equal.

B Manufacturers of accessories shall be as listed herein below.

2.2 FUEL TANK

A. Furnish and install an aboveground, double wall, insulated, fuel storage tank with steel primary and secondary as specified herein and as shown on the Drawings.

B. Rectangular tank capacity and dimensions:

1. Nominal Capacity: 2,000 gallons
2. Maximum Dimensions:
 - a. Length: 13 feet
 - b. Width: 7 feet

C. Construct fuel tank in conformance to NFPA 30 and Uniform Fire Code. Tank shall be UL listed. Tank shall maintain both primary and secondary tank integrity after UL 1709 2-hour fire exposure. Tank shall meet UFC Standard A-II-F-1 (formerly 79-7).

D. Provide tank complete with connections for the suction/return, vent, level gage tank connections, fill and emergency tank vents, and leak detection tube.

E. Seismically restrain and anchor fuel tank by using cast-in-place anchor bolts.

2.3 ACCESSORIES

A. Fill Inlet: Fill inlet tank connection (4 inch) shall include a spill containment pan, fill adapter, and fill cap. The containment pan shall have a drain tube that drains any spillage back into the tank and shall be mounted flush to the top of the tank. The containment pan shall have a 5-gallon capacity. The cover shall have a lockable hasp. Fill inlet assembly shall include: OPW Model 634-TT cap, No. 633-T adapter; Emco-Wheaton Model A-0049 cap, No. A-0030 adapter; or equal.

B. Suction Assembly: Suction assembly shall be 1 inch black steel suction pipe, OPW Model No. 92-0033 double poppet foot valve; equivalent products by Emco-Wheaton; or equal. Furnish and install suction assembly with 3-inch minimum clearance from tank bottom to foot valve. Furnish and install a 1-inch threaded suction connection.

C. Return Assembly: 1-inch threaded return connection.

D. Aboveground Flex Connector:

1. Stainless steel outer braiding and inner pipe.
2. UL approved and meet UFC requirements for aboveground fuel tanks.
3. Manufacturer: Anamet or equal.

E. Emergency Vent: Morrison Bros. 244-LS or equal, provided for each tank.

F. Vent Assembly: Vent pipe shall be 2-inch galvanized schedule 40 steel

pipe. Normal operating be 2 inch vent caps shall be OPW Model 23, Emco Wheaton Model A-41303, or equal. Install vent caps a minimum of 12-feet off the ground.

G. Liquid Level Gage:

1. An easy to read visual gage and observable during tank filling.
2. Manufacturer: Therma-Gauge, Type H-2 by Krueger; or equal.

2.4 PRODUCT PIPING

Piping routinely carrying fuel shall be steel as defined herein.

A. Secondary Containment Piping

Belowground piping carrying fuel shall be secondarily contained, unless otherwise indicated. Piping system shall be of double-wall construction with the internal pipe being the product pipe and the exterior pipe being an fiberglass reinforced plastic containment pipe as defined herein. Piping system shall be a factory manufactured piping system designed in accordance with ASME B31.3 and NFPA 30. The containment piping shall allow for complete inspection of the product piping before the containment piping is sealed. Containment piping shall be chemically compatible with the type of fuel to be handled. Containment piping shall be non-corrosive, dielectric, non-biodegradable, and resistant to attack from microbial growth. Containment piping shall be capable of withstanding a minimum 5 psi air pressure. Containment piping shall be evenly separated from the primary pipe using pipe supports which are designed based on pipe size, pipe and fuel weight, and operating conditions. The supports shall be constructed of FRP and shall be designed so that no point loading occurs on the primary or exterior pipe. Supports shall be permanently attached to the product pipe by an adhesive.

PART 3 EXECUTION

3.1 INSTALLATION

A. Tank: Install in strict conformance to manufacturer's installation instructions.

B. Piping: Install new piping from the aboveground fuel tank to the hose line for the engines in accordance with Section 15200.

3.2 FIELD QUALITY CONTROL

A. Testing for Leaks:

1. Pneumatically test primary and secondary fuel containment tanks after installation at 5 psig for a minimum of one hour without loss of air pressure.
2. Disconnect fuel and vent piping from tank, seal ends and pneumatically test at 100 psig for not less than 1 hour.
3. Retest piping, if corrections are required, until the 1-hour test is successfully passed.
4. Initial air pressure may be corrected for temperature effects when evaluating the test results at the end of the one hour test period,

should there be a change in air temperature during the test period.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13211

WELDED STEEL TANK

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUMMARY
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE

PART 2 PRODUCTS

- 2.1 GENERAL
- 2.2 DESIGN CRITERIA
- 2.3 TANK DESIGN
- 2.4 TANK ACCESSORIES
- 2.5 FABRICATION
- 2.6 SOURCE QUALITY CONTROL

PART 3 EXECUTION

- 3.1 PREPARATION
- 3.2 ERECTION
- 3.3 FIELD QUALITY CONTROL
- 3.4 PAINTING
- 3.5 DISINFECTION
- 3.6 TESTING FOR VOLATILE ORGANICS
- 3.7 DISPOSAL OF TEST WATER

-- End of Section Table of Contents --

SECTION 13211

WELDED STEEL TANK

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Iron and Steel Institute (AISI)

American Society for Testing and Materials Standard Specifications (ASTM)

ASTM A123 Zinc (Hot-Dipped Galvanized) Coatings on
Iron and Steel Products

ASTM B633 Electrodeposited Coatings of Zinc on Iron
and Steel

American Welding Society (AWS)

AWS D10.4 Recommended Practices for Welding
Austenitic Chromium-Nickel Stainless Steel
Piping and Tubing

American Water Works Association Standards (AWWA)

AWWA D100 Welded Steel Tanks for Water Storage

AWWA D102 Painting Steel Water Storage Tanks

AWWA C652 Disinfection of Water Storage Facilities

AWWA C200 Steel Water Pipe

AWWA C207 Steel Pipe Flanges for Waterworks Service

AWWA C213 Fusion-Bonded Epoxy Coating for the
Interior and Exterior of Steel Water
Pipelines

California Code of Regulations, Title 8: Industrial Safety (CCR)

Uniform Building Code (UBC)

1.2 SUMMARY

A. Section Includes: All labor, material, equipment, tools and services required for the design, fabrication, erection, painting and testing of a ground level, welded steel backwash storage tank and accessories.

B. Related Sections:

1. Section 09960: Protective Coatings
2. Section 11003: Disinfection
3. Section 15200: Pipelines, Liquid Process Piping

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Product Data; FIO.

1. Hangers, pipe and equipment supports.
2. High-strength bolts.
3. Stainless steel items.
4. Manufactured items, including access hatches, vents and safety devices.

Calculations; FIO.

1. Design calculations for tank and accessories.
2. Depth versus volume calibration table for the tank in units of inches, feet and gallons.

SD-04 Drawings

Shop Drawings; FIO.

Fabrication and erection drawings for tank and all accessories, including all welding details.

SD-13 Certificates

Manufacturer's Certifications; FIO.

1. Tank design, including welded joint details and inspection personnel data.
2. Tank fabrication, including mill tests and shop inspection report.
3. Tank erection, including field inspection and testing report.

1.4 QUALITY ASSURANCE

A. General:

1. Demonstrate that the tank manufacturer has been regularly designing, fabricating and erecting similar steel tanks for at least 10 years.
2. Stamp and sign all shop drawings, calculations and welded joint details by a Civil Engineer registered in California.
3. Supply all new materials and fabricated items.
4. Verify adequacy of tank foundation.

B. Codes and Standards:

1. Tank Manufacture: AWWA D100.
2. Safety of Access: CCR and UBC.

C. Testing Program:

1. Qualification of Weld Procedures: AWWA D100.
2. Qualification of Welders: AWWA D100.
3. Shop and Field Weld Inspection: AWWA D100. If Section 14 applies, retain a Certified Welding Inspector.
4. Weld Inspection Procedures: AWWA D100.
5. Tank Bottom Weld Testing: AWWA D100.
6. Tank Water Tests: AWWA D100, bacteriological and complete volatile organic compound test per California Department of Health Services latest requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. Tank Manufacture: AWWA D100. Note also:

1. If Section 14 is used in tank design, all provisions must be incorporated.
2. Copper-bearing steel is not required.

B. Safety: CCR and UBC.

C. Seismic Requirement: Provide positive anchorage between tank and ringwall. Comply with requirements specified in Section 2.2 and on Drawings.

2.2 DESIGN CRITERIA

A. AWWA D100 and also:

1. Roof dead load:
2. Roof live load: 20 psf.
 - a. Within guardrails: 50 psf.
 - b. Outside guardrails: 20 psf
3. Metal temperature: $25^{\circ}\text{F} + 15^{\circ}\text{F} = 40^{\circ}\text{F}$.
4. Wind load: 25 psf.
5. Seismic design: AWWA D100, Section 13 and also:
 - a. Modified zone coefficient, $Z = 0.30$.
 - b. Use Factor, $I = 1:25$.
 - c. Modified Force Reduction Coefficient, $R_w = 4.5$.
 - d. Site amplification factor, $S = 1.5$.
 - e. Apply horizontal and vertical accelerations simultaneously.
 - f. Hoop stress combination: Root Mean square method.
 - g. Pressure stability: check with tank full.
6. Tank anchor system: Resist tension from seismic overturning moment (AWWA D100 equation 13.8), without any reduction for vertical loads.
 - a. Design anchors for 1/3 stress increase over basic allowable stress.
 - b. Design anchor connections at basic allowable stresses.
7. Soil bearing pressures:

- a. Dead and live or operating loads: 1,200 psf.
- b. Dead, live, operating loads plus seismic or wind loads: 1,600 psf.
- 8. Construction loads: Distribute roof concentrated loads so the specified uniform live load is not exceeded. Provide roof shoring where necessary.

2.3 TANK DESIGN

- A. Roof: Design purlins and rafters for seismic water sloshing where it will occur. Provide continuous fillet welds all around lapped surfaces at all purlin and rafter connections and beam supports.
- B. Corrosion Allowance: 1/16-inch to all plates.
- C. Roof-to-Shell Joint: Continuous fillet welds, each side of shell (Knuckle plate) and roof plates.
- D. Shell Circumferential Joints: Complete penetration butt joints.
- E. Column Bases: Design to distribute column load plus water pressure on plating without exceeding soil bearing pressure.

2.4 TANK ACCESSORIES

- A. General: Provide the tank complete with all pipe connections, access openings, nozzles, taps, drains, ladders, and other accessories as shown on the Drawings or required herein. All accessories shall conform to the AWWA D100 and as specified.
- B. Stainless Steel Items: Provide AISI Type 304 material, unless Type 316 is specifically specified.
- C. Shell Manholes: 36-inch-diameter manholes located in the shell and centered above the tank bottom as shown on the Drawings. Provide number of manhole as shown on Drawings. Provide suitable means to hold the manhole covers in the open position. Hinge shall be loose, so that easy bolting is possible. Hot-dip galvanize after factory fabrication and before installation.
- D. Piping and Pipe Connections:
 - 1. Pipe: AWWA C200, Schedule 20.
 - 2. Pipe coating and lining: AWWA C213.
 - 3. Pipe flanges: AWWA C207, Class B.
 - 4. Provide fusion-bonded epoxy coated and lined, welded steel inlet, outlet, overflow and drain piping.
 - 5. Outlet pipe: Provide vortex breaker plate assembly.
 - 6. Overflow pipe: Provide external overflow with support system.
 - 7. Pipe connections: Locate exterior face of flanges 6 inches minimum from shell plate, unless shown otherwise.
- E. Roof Access:
 - 1. Provide an exterior steel ladder and guarded, safe access to the roof hatch and a stainless steel interior ladder from the roof hatch to

the interior floor of the tank, all in accordance with the UBC and CCR.

Hot-dip galvanize all parts of the steel ladders, guardrails, chain closure, access platform, and ladder supports after factory fabrication and prior to field installation. Provide an insulation connection between steel tank and stainless ladder connections.

2. Exterior Ladder: Furnish with a lockable access prevention at the bottom ladder and at the bottom of the fall prevention safety cage, steel construction that conforms to UBC and CCR.

3. Interior Ladder: Furnish with a ladder fall prevention safety device of stainless steel (in lieu of a safety cage) that conforms with UBC and CCR. Provide a removable extension for the ladder safety device above the roof hatch and other appurtenances required for use of the safety devices, including two personnel full body harnesses by DBI/Sala or equal.

4. Roof Hatch: Provide weathertight, hinged steel cover raised 3 inches minimum above roof. Select a cover that opens a full 180°, locks when open and can be pushed open from inside the tank. Support 300 lbs. on cover when closed.

5. Guardrail: Provide around the roof hatch and ladder area in accordance with UBC and CCR.

6. Chain Closure: Provide 5/16-inch weldless carbon steel oblong link chain at each rail level. Fasten with boat type snap hook at one end and eye bolt at the other end.

F. Vents:

1. Provide fiberglass reinforced plastic center roof vent with screened opening, removable top adequately sized to vent tank and provide an emergency overflow of 3,500 gpm for the Backwash Storage Tank.

2. Provide screens over vent. Manufacturer shall verify that adequate venting is provided to equalize pressure and prevent buckling of the tank. Screens shall be designed to pop out into the interior of the tank if the internal tank pressure becomes large enough to cause buckling of the tank shell. Maximum tank in/out flow for venting design is 3,500 gpm for the Backwash Storage Tank.

3. The screen shall consist of an 8x8 Type 316 stainless steel mesh, 0.028 wire diameter or favorably reviewed equal.

G. Sight Level Gauge:

1. Provide float-operated gauge.

2. Steel with baked enamel coating, black numbers and gradations on white background, full height of tank sidewall.

3. Scale: Feet and tenths of feet.

H. Zinc Coatings:

1. Bolts, Washers and Nuts: Electrodeposited zinc-coated to conform with ASTM B633.

2. Other Galvanized Items: Hot-dipped zinc-coated to conform with ASTM A123.

I. Miscellaneous:

1. Provide connection in shell plate for level (pressure) transmitter.

J. Backwash Storage Tank Specific Accessories:

1. Provide flush type cleanout with electric operated plug valve as shown on the Drawings.
2. Provide guide rail.

2.5 FABRICATION

- A. AWWA D100 and also:
1. Fabricate and assemble in the shop to the greatest extent possible.
 2. Shape all members correctly, with no kinks, twists, dents or other blemishes prior to erection. Evenly spring all curved work.
 3. Make exposed edges free of burrs and sharp edges. Make corners rounded or chamfered.
 4. Shop prime all steel items which are not galvanized or epoxy-coated, with material that is compatible with the finish coat.

2.6 SOURCE QUALITY CONTROL

- A. Material: Verify that satisfactory mill test reports are available on all steel, including stainless steel.
- B. Welding:
1. Verify welders are qualified.
 2. Verify that weld procedures are followed.
- C. Report: Provide a shop inspection report including mill tests, radiographs and inspection records, before tank erection is started.

PART 3 EXECUTION

3.1 PREPARATION

- A. Develop a written erection plan and welding sequences for the tank bottom, side shell and roof plating.
- B. Develop this plan and sequences to minimize welding distortions and kinks between plates.
- C. Furnish this plan and sequences to the erection crew.

3.2 ERECTION

- A. AWWA D100 and also:
1. Comply with erection plan and welding sequences.
 2. Follow qualified weld procedures.
 3. Use qualified welders.
 4. Provide complete penetration butt welds at all side shell joints.
 5. Remove all evidence of any welding of temporary erection devices.
 6. Stainless steel items:
 - a. Use the proper type of stainless steel electrodes or welding rods complying with AWS D10.4.
 - b. Remove by grinding and polishing, all scratches, marks, pits and other blemishes on exposed surfaces.
 - c. Use grinding wheels and other tools that have never been used on carbon steel.

3.3 FIELD QUALITY CONTROL

- A. AWWA D100, and also:
 - 1. Provide 24-hours notice of all testing to Contracting Officer.
 - 2. Provide all testing equipment and satisfactory access to the work being inspected.
 - 3. Perform and evaluate all radiographs promptly, so any repairs can be made and re-evaluated without delay of the erection.
 - 4. The Contracting Officer will judge compliance with the quality of work specified herein or in AWWA D100.
 - 5. Repair all leaks and retest by the same method that discovered the leak.
- B. Tank Welding:
 - 1. If AWWA 0100-Chapter 14, Alternative Design Basis, applies retain a Certified Welding Inspector to be present during all inspections and testing and to specify the test locations.
 - 2. Inspection by trepanning, air carbon arc gouging and removal of sectional segments will not be permitted.
- C. Tank Bottom: Test all joints by the vacuum method after erection and prior to painting.
- D. Tank Bottom and Side Shell: Test by the water method, after erection and prior to painting. The Contractor shall be responsible for proper disposal of water used for testing the tank leakage integrity.
- E. Report: Provide a field inspection report, including radiographs and inspection records before acceptance of the tank by the Government.

3.4 PAINTING

- A. Perform interior and exterior cleaning, preparation, and painting in accordance with AWWA D102 and Section 09960 and as specified herein.
 - 1. Paint top surfaces of all purlins, rafters, beams and all other roof structural members prior to the roof plate installation.
 - 2. Paint lower side of roof plates prior to installation.
 - 3. Caulk all unwelded roof plate and structural member laps, prior to painting.
 - 4. Caulking material; polyurethane sealant; PRC Permapad RC-270, Vulkem 921, or equal - Apply in accordance with the manufacturer's instructions.
 - 5. At columns, paint the top side of floor plates and the underside of column base plates prior to column erection.
- B. Provide a first year anniversary inspection of the tank painting, including testing and any required repair work, at no additional cost to the Government.

3.5 DISINFECTION

After protective coatings have been applied and accepted, disinfect the interior tank surfaces in the presence of the Contracting Officer in

accordance with the requirements of AWWA C652 and Section 11003.

3.6 TESTING FOR VOLATILE ORGANICS

Refer to Section 09960 for requirements relating to testing for volatile organics.

3.7 DISPOSAL OF TEST WATER

Water used for testing and disinfection procedures shall be disposed to the nearby sewer. Discharge times of the water to the new sewer shall be coordinated between the Contractor and Contracting Officer.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13405

PROCESS CONTROLS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 CONTROL SYSTEM DESCRIPTION
 - 1.2.1 Control System General Requirements
 - 1.2.2 Control System Operation
 - 1.2.3 Control System Points
 - 1.2.4 Symbols, Definitions, and Abbreviations
- 1.3 ENVIRONMENTAL CONDITIONS
- 1.4 SUBMITTALS
- 1.5 DATA TRANSMISSION SYSTEMS (DTS)
- 1.6 EQUIPMENT REQUIREMENTS
 - 1.6.1 Materials and Equipment
 - 1.6.2 Nameplates
- 1.7 Sequencing of Construction
- 1.8 Instrument Schedule

PART 2 PRODUCTS

- 2.1 GENERAL REQUIREMENTS
- 2.2 MONITORING AND CONTROL PARAMETERS
 - 2.2.1 Transmitter
 - 2.2.2 Flow Sensor
 - 2.2.2.1 Propeller Flowmeter
 - 2.2.2.2 Magnetic Flowmeter
 - 2.2.3 Level Instrumentation
 - 2.2.3.1 Conductivity Switch
 - 2.2.3.2 Ultrasonic Sensor
 - 2.2.3.3 Diesel Fuel Tank Leak Detector
 - 2.2.4 Pressure Instrumentation
 - 2.2.4.1 Pressure Sensor
 - 2.2.4.2 Pressure Switch
 - 2.2.4.3 Differential Pressure
 - 2.2.4.4 Differential Pressure Switch
 - 2.2.4.5 Pressure and Vacuum Gauges
 - 2.2.5 Process Analytical Instrumentation
 - 2.2.5.1 Fluoride
 - 2.2.5.2 Chlorine in Liquid
 - 2.2.5.3 pH Monitoring
- 2.3 PROGRAMMABLE LOGIC CONTROLLER (PLC)
 - 2.3.1 PLC General Requirements

- 2.3.2 Modular PLC
 - 2.3.2.1 Central Processing Unit (CPU) Module
 - 2.3.2.2 Communications Module
 - 2.3.2.3 Power Supply Module
 - 2.3.2.4 Input/Output (I/O) Modules
- 2.3.3 Program Storage/Memory Requirements
- 2.3.4 Input/Output Characteristics
- 2.3.5 Wiring Connections
- 2.3.6 On-Off Switch
- 2.3.7 Diagnostics
- 2.3.8 Accuracy
- 2.4 PLC SOFTWARE
 - 2.4.1 Operating System
 - 2.4.1.1 Startup
 - 2.4.1.2 Failure Mode
 - 2.4.2 Functions
 - 2.4.2.1 Analog Monitoring
 - 2.4.2.2 Logic (Virtual)
 - 2.4.2.3 State Variables
 - 2.4.2.4 Analog Totalization
 - 2.4.3 Alarm Processing
 - 2.4.3.1 Digital Alarms
 - 2.4.3.2 Analog Alarms
 - 2.4.3.3 Pulse Accumulator (PA) Alarms
 - 2.4.4 Constraints
 - 2.4.4.1 Equipment Constraints Definitions
 - 2.4.4.2 Constraints Checks
 - 2.4.5 Control Sequences and Control Loops
 - 2.4.6 Command Priorities
 - 2.4.7 Resident Application Software
 - 2.4.7.1 Program Inputs and Outputs
 - 2.4.7.2 Failure Mode
- 2.5 CONTROL PANELS
 - 2.5.1 Components
 - 2.5.1.1 Enclosures
 - 2.5.1.2 Controllers
 - 2.5.1.3 Standard Indicator Light
 - 2.5.1.4 Selector Switches
 - 2.5.1.5 Push Buttons
 - 2.5.1.6 Relays
 - 2.5.1.7 Terminal Blocks
 - 2.5.1.8 Alarm Horns
 - 2.5.2 Panel Assembly
 - 2.5.3 Electrical Requirements
 - 2.5.4 Grounding
 - 2.5.5 Ventilation System
- 2.6 CENTRAL STATION AND OPERATORS WORKSTATION EQUIPMENT
 - 2.6.1 Uninterruptible Power Supply (UPS)
- 2.7 USER INTERFACE
 - 2.7.1 Graphical Operations
 - 2.7.1.1 Operator User Interface (OI)
 - 2.7.1.2 Display Information
 - 2.7.1.3 System Graphics Implementation
 - 2.7.1.4 Display Editor

- 2.7.1.5 Graphical Object Oriented Programming
- 2.7.2 Command Software
 - 2.7.2.1 Operator's Commands
- 2.7.3 Alarms
- 2.8 DATA COMMUNICATION REQUIREMENTS
- 2.9 FACTORY TEST
 - 2.9.1 Factory Test Setup
 - 2.9.2 Factory Test Procedure
 - 2.9.3 Factory Test Report

PART 3 EXECUTION

- 3.1 EQUIPMENT INSTALLATION REQUIREMENTS
 - 3.1.1 Installation
 - 3.1.1.1 Isolation, Penetrations of Buildings and Clearance from Equipment
 - 3.1.1.2 Device Mounting
 - 3.1.2 Sequences of Operation
- 3.2 INSTALLATION OF EQUIPMENT
 - 3.2.1 Control Panels
 - 3.2.2 Flow Measuring Device
 - 3.2.2.1 Magnetic Flowmeter
 - 3.2.3 Level Instruments
 - 3.2.3.1 Conductivity Switch
 - 3.2.3.2 Ultrasonic Sensor
 - 3.2.4 Pressure Instruments
 - 3.2.5 Enclosures
- 3.3 WIRE, CABLE AND CONNECTING HARDWARE
 - 3.3.1 LAN Cables and Connecting Hardware
 - 3.3.2 Metering and Sensor Wiring
 - 3.3.2.1 Sensor and Control Wiring Surge Protection
- 3.4 SOFTWARE INSTALLATION
- 3.5 FIELD TESTING AND ADJUSTING EQUIPMENT
 - 3.5.1 Testing, Adjusting and Commissioning
 - 3.5.2 Performance Verification Test (PVT)
 - 3.5.3 Endurance Test
 - 3.5.3.1 Phase I (Testing)
 - 3.5.3.2 Phase II (Assessment)
 - 3.5.3.3 Exclusions
- 3.6 MANUFACTURER'S FIELD SERVICES
- 3.7 INSTRUMENTATION AND CONTROL SYSTEM
- 3.8 FIELD TRAINING
 - 3.8.1 Preliminary Operator Training
 - 3.8.2 Additional Operator Training
 - 3.8.3 Maintenance Training
 - 3.8.4 Specialized Training
 - 3.8.4.1 Flow Meter Training
 - 3.8.4.2 Specialized Sensor Training

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 13405

PROCESS CONTROLS

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced and are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(1995) Code for Electricity Metering
ANSI X3.64	(1979; R 1990) Additional Controls for Use with American National Standard Code for Information Interchange
ANSI X3.154	(1988; R 1994) Office Machines and Supplies - Alphanumeric Machines-Keyboards Arrangement

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 88	(1996) Seamless Copper Water Tube
ASTM B 88M	(1996) Seamless Copper Water Tube (Metric)
ASTM D 635	(1997) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM D 638	(1997) Tensile Properties of Plastics
ASTM D 792	(1991) Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D 1238	(1995) Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D 1693	(1997a) Environmental Stress - Cracking of Ethylene Plastics

AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR CONDITIONING ENGINEERS (ASHRAE)

ASHRAE Hdbk-IP (1997) Handbook, Fundamentals I-P Edition

ASME INTERNATIONAL (ASME)

ASME-18 (1971; Int Supple 19.5, 1972; Errata)
Fluid Meters, Their Theory and Application

ASME B31.8 (1995) Gas Transmission and Distribution
Piping Systems

ASME BPV VIII Div 1 (1998) Boiler and Pressure Vessel Code;
Section VIII, Pressure Vessels Division I
- Basic Coverage

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 60 Standards of Performance for New
Stationary Sources

47 CFR 15 Radio Frequency Devices

47 CFR 68 Connection of Terminal Equipment to the
Telephone Network

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA ANSI/EIA/TIA-232-F (1997) Interface Between Data Terminal
Equipment and Data Circuit-Terminating
Equipment Employing Serial Binary Data
Interchange

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.90 (1989; R 1994) Relays and Relay Systems
Associated with Electric Power Apparatus

IEEE C37.90.1 (1989; R 1994) Surge Withstand Capability
(SWC) Tests for Protective Relays and
Relay Systems

IEEE C62.41 (1991; R 1995) Surge Voltages in
Low-Voltage AC Power Circuits

IEEE Std 100 (1996) IEEE Standard Dictionary of
Electrical and Electronic Terms

IEEE Std 142 (1991) IEEE Recommended Practice for
Grounding of Industrial and Commercial
Power Systems

IEEE Std 8802-3 (1996) Local and Metropolitan Area
Network: Carrier Sense Multiple Access
with Collision Detection (CSMA/CD) Access
Method and Physical Layer Specifications

IEEE Std 8802-4 (1990; 802.4b; 802.4h; R 1995) Information Processing Systems - Local Area Networks - Part 4: Token-Passing Bus Access Method and Physical Layer Specifications

INTERNATIONAL ELECTROMECHANICAL COMMISSION (IEC)

IEC 1131-3 Programmable Controllers - Part 3: Programming Language

INTERNATIONAL TELECOMMUNICATIONS UNION (ITU)

ITU V.34 (1994) Data Communication Over the Telephone Network - A Modem Operating at Data Signaling Rates of up to 28,800 bits for use on the General Switched Telephone Network and on leased Point-to-Point Two-Wire Telephone Type Circuits.

ITU V.42 bis (1990) Data Compression Procedures for Data Circuit Terminating Equipment (DCE Using Error-Correction Procedures)

ISA (ISA)

ISA MC96.1 (1982) Temperature Measurement Thermocouples

ISA S7.0.01 (1996) Quality Standards for Instrument Air

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1 (1993) Industrial Control and Systems

NEMA ICS 2 (1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC

NEMA ICS 3 (1993) Industrial Control and Systems Factory Built Assemblies

NEMA ICS 4 (1993) Industrial Control and Systems Terminal Blocks

NEMA 250 (1991) Enclosures for Electrical Equipment (100 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST SP 250 (1991) Calibration Service Users Guide

SIEMENS PRODUCT

Specification Data 144-130 (1999) Siemens APOGEE Automation Product,
Rev. 4, June 1999

UNDERWRITERS LABORATORIES (UL)

UL 94 (1996; Rev thru Jul 1998) Tests for
Flammability of Plastic Materials for
Parts in Devices and Appliances

UL 508 (1993; Rev thru Oct 1997) Industrial
Control Equipment

UL 1059 (1993; 3rd Edition) Standard for Terminal
Blocks

1.2 CONTROL SYSTEM DESCRIPTION

The process instrumentation and control system shall be used to monitor and control the operation of process equipment as specified and in accordance with the sequence of control and control schematics shown on the drawings. The control system shall provide for operator interaction, overall control system supervision, and process equipment control and monitoring. The Contractor shall provide hardware configured and sized to support expansion as specified and shown on the drawings. The Contractor is responsible for a complete working system, including all components, testing start-up and custom programming. Reference Section 13410.

1.2.1 Control System General Requirements

The control system shall consist of a programmable logic controller (PLC) with a specialized communication card, all mounted in a control panel, and field instruments. The PLC shall interface with a local Siemens FID/DTC. The PLC shall include a custom program: reference specification Section 13410.

1.2.2 Control System Operation

The control system provided under this specification shall operate using ladder logic programming to provide the required sequences of operation. Input data to the controller shall be obtained by using instruments and controls interfaced to mechanical, electrical, utility systems and other systems as shown and specified. All required setpoints, settings, alarm limits, and sequences of operation shall be as identified in the instrument schedule, in specification Section 13410 or as shown on the drawings. The number and location of control panels shown on drawings shall be provided as a minimum.

1.2.3 Control System Points

Inputs to and outputs from the control system shall be in accordance with the Process and Instrumentation Diagrams shown on the drawings. Each connected analog output (AO), analog input (AI), digital output (DO), digital input (DI), pulse accumulator (PA) input and other input or output device connected to the control system shall represent a "point" where referred to in this specification.

1.2.4 Symbols, Definitions, and Abbreviations

Symbols, definitions, and engineering unit abbreviations shall conform to ISA and IEEE Std 100, as applicable.

1.3 ENVIRONMENTAL CONDITIONS

Capacity and design of the air moving equipment and accessories shall be suitable for 24-hour full load service and shall meet the following criteria.

a. Location

Altitude (above MSL) 500 ft. max.

Outside Air Temperature 115 degrees F max.

Inside Air Temperature 90 degrees F max.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Instrumentation and Control System; GA

Manufacturer's descriptive and technical literature, performance charts and installation instructions. Product specific catalog cuts shall be in booklet form, indexed to the unique identifiers, and shall consist of data sheets that document compliance with the specification. Where multiple components are shown on a catalog cut, the application specific component shall be marked.

Meters and Sensors; GA

Manufacturer's descriptive and technical literature, catalog cuts, performance charts and installation instructions.

Training Manual; FIO

Instruction manual within 180 days of Notice to Proceed.

Performance Verification Test (PVT); GA

The performance verification test procedure; it shall refer to the actions and expected results to demonstrate that the control system performs in accordance with the sequence of control. A list of the equipment to be used during the testing shall be included. The list shall also include manufacturer's name, model number, equipment function, the date of the latest calibration and the results of the latest calibration.

SD-04 Drawings

Installation; GA

Wiring; GA

Detail drawings containing complete piping, wiring, schematic, flow diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall include, as appropriate: product specific catalog cuts; a drawing index; a list of symbols; a series of drawings for each control system using abbreviations, symbols, nomenclature and identifiers as shown; valve schedules; compressed instrument air station schematics and ASME air storage tank certificates for each type and make of compressed instrument air station.

Interconnection Wiring Diagrams; GA

Submit point-to-point type interconnection diagrams similar to the format on Sheet I9.0. Include each conduit run, with wire fill noted for each run. Include electric panel and circuit numbers for all sources of 120 Vac power. Show conduit and wiring interconnections between each control panel, instrument, multiplexer or telemetry unit, motor control center, motor combination starter, valve actuator, pump, motor, and other field-mounted devices. List all reference documents. Include all equipment and appurtenances provided in this contract regardless of the Division in which it is specified. Interconnection diagrams shall be prepared under the supervision of a Registered Engineer and shall bear the engineer's stamp and signature.

SD-09 Reports

Factory Test Report;

Testing, Adjusting and Commissioning;

Performance Verification Test(PVT);

Endurance Test;

Test results in report format; GA

Calibration test data; FIO

SD-13 Certificates

Sensor and Control Wiring; GA

Certification stating that the test was performed in accordance with IEEE Std 142.

SD-19 Operation and Maintenance Manuals

Instrumentation and Control System; GA

Six complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include layout, wiring and control diagrams of the system as installed. The instructions shall include the manufacturer's name, model number, service manual, parts list and a brief description of all equipment and their basic operating features.

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs and trouble shooting guides.

1.5 DATA TRANSMISSION SYSTEMS (DTS)

Data transmission systems for communication between the PLC and local FID/DTC and as shown on the drawings and described in 13410 and 13820.

1.6 EQUIPMENT REQUIREMENTS

1.6.1 Materials and Equipment

Materials and equipment shall be standard unmodified products of a manufacturer regularly engaged in the manufacturing of such products. Units of the same type of equipment shall be products of a single manufacturer. Items of the same type and purpose shall be identical and supplied by the same manufacturer, unless replaced by a new version approved by the Government.

1.6.2 Nameplates

Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. Laminated plastic nameplates shall be provided for equipment devices and panels furnished. Each nameplate shall identify the device, such as pump "P-1" or valve "VLV-402". Labels shall be coordinate with the schedules and the process and instrumentation drawings. Laminated plastic shall be 1/8 inch thick, white with black center core. Nameplates shall be a minimum of 1 by 3 inches with minimum 1/4 inch high engraved block lettering. Nameplates for devices smaller than 1 by 3 inches shall be attached by a nonferrous metal chain. All other nameplates shall be attached to the device.

1.7 Sequencing of Construction

Construction shall be sequenced as described in specification and on drawings.

1.8 Instrument Schedule

See Instrument Schedule at the end of this section.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

Equipment located outdoors, not provided with climate controlled enclosure, shall be capable of operating in the ambient temperature range indicated in paragraph ENVIRONMENTAL CONDITIONS, unless otherwise specified. Electrical equipment will conform to Division 16000. Equipment and wiring must be in accordance with NFPA 70, with proper consideration given to environmental conditions such as moisture, dirt, and corrosive agents

2.2 MONITORING AND CONTROL PARAMETERS

The control system shall be complete including sensors, field preamplifiers, signal conditioners, offset and span adjustments, amplifiers, transducers, transmitters, control devices, engineering units conversions and algorithms for the applications; and shall maintain the specified end-to-end process control loop accuracy from sensor to display and final control element. Control equipment shall be powered by a 120 Vac, single phase, 60 Hz power source, with local transformers included as needed for signal transmission and subsystem operation. Connecting conductors shall be suitable for installed service. Enclosures shall be rated for NEMA 12 unless noted otherwise.

2.2.1 Transmitter

Unless indicated otherwise, each sensor shall be provided with a transmitter, selected to match the sensor. Except where specifically indicated otherwise on the drawings, the transmitter shall be provided with a four digit display of the measured parameter (calibrated in engineering units) and shall provide a 4 to 20 mA_{dc} output signal proportional to the level of the measured parameter. Accuracy shall be plus or minus 0.5 percent of full scale reading with output error not exceeding plus or minus 0.5 percent of the calibrated measurement. Transmitter shall be located where indicated, mounted integrally with the sensor, pipe mounted, wall mounted or installed in the control panel. The distance between the sensor and transmitter shall not exceed the manufacturer's recommendation. Field preamplifiers, cabling, and signal conditioners shall be included when necessary to maintain the accuracy from sensor to the programmable logic controller. All transmitters shall be capable of accepting a 10 V_{dc} to 60 V_{dc} source voltage.

2.2.2 Flow Sensor

Liquid flow indication shall be provided in gpm. Unless indicated otherwise, the flow transmitter shall produce a signal that is proportional to the volumetric flow rate, compensated for fluid temperature, and shall have an accuracy of plus or minus 1 percent of the actual flow. The flow transmitter shall include a digital readout of the volumetric flow rate to 3 significant figures. The transmitter shall provide a 4-20 mA_{dc} output signal to the programmable logic controller, proportional to the measured

parameter. Flow transmitters and flow elements shall be capable of being mounted 250 feet apart (minimum).

2.2.2.1 Propeller Flowmeter

A. Propeller meters shall feature a magnetic type drive which shall prevent the process fluid from contacting any gears, bearings, shafts, etc., within a hermetically meter register. The rotation of the propeller shall be transmitted via the magnetic drive to the register and transmitter (where required) by means of a rigid shaft. The propeller shall be of 3-bladed conical design, constructed of rigid plastic that will not flex or otherwise change in dimension under maximum fluid velocity through the meter. The register case shall be hermetically sealed with a hinged lens cover and clasp.

B. Propeller Meter: All wetted parts of meters and straightening vanes shall be corrosion resistant and compatible with the fluid. The fluid shall be water. Meters shall be manufactured to comply with all applicable requirements of AWWA C704. All flanged-tube type meters shall mate with 150-pound flanges specified in Section 15050.

Straightening vanes shall be furnished and installed upstream from the meter according to the manufacturer's recommendations. Each propeller meter shall register flow to within $\pm 2\%$ of actual flowrate. Meters shall be provided a watertight or hermetically sealed register consisting of a rate indicator and 6-digit totalizer.

A certified copy of the calibration taken at or near minimum flow rating, at midrange, and at the highest flow rate within the range attainable by the test facility shall be furnished to the Contracting Officer for favorable review.

C. Accessories: Where shown, provide a 2-wire 4-20 mA flowrate remote mounted transmitter in place of the meter register. This may consist of a self-contained unit, or a pulse transmitter module which provides a signal rate of 10 to 20 pulses per second at maximum flowrate. The transmitter housing shall have a submersible rating. A loop powered pulse-to-current converter mounted in a NEMA 3R enclosure and suitable for panel mounting shall be provided.

2.2.2.2 Magnetic Flowmeter

Magnetic flowmeter shall be non-intrusive and shall measure fluid flow through the use of a self generated magnetic field. The magnetic flow element shall be encapsulated in anodized aluminum. Flowmeter shall be capable of measuring clean flow up to a maximum flow velocity of 10 fps. The flowmeter shall be bidirectional. The metering tube shall be constructed of material compatible with the fluid being measured. The maximum pressure drop across the meter and appurtenances shall be 5 psi at the maximum flow rate. Flow elements mounted remote from transmitters and below grade shall be rated for submergence. The Contractor shall pay special attention to the distances between elements and transmitters.

2.2.3 Level Instrumentation

The transmitter shall be provided with a minimum of three sets of dry contacts rated in accordance with NEMA ICS 1. The first set of contacts shall close when the lower (warning) detection level has been exceeded. The second set of contacts shall close when the upper (alarm) detection level has been exceeded. The third set of contacts shall close when a controller malfunction has occurred, including loss of power or loss of sensor input. The alarm levels shall be individually adjustable. The transmitter shall provide a 4-20 mA_{dc} output signal to the programmable logic controller, proportional to the measured parameter. The controller shall be provided with an internal battery to maintain operation for a minimum of 12 hours if power is lost.

2.2.3.1 Conductivity Switch

The switch shall detect the presence of a fluid by measuring the electrical resistance between a sensor and a ground electrode. Electrodes shall be constructed of 316 stainless steel. Electrodes shall be fully clad using polyolefin. The conductivity switch shall be capable of 3 separate level set points. Unless noted otherwise, the switch shall be provided with a ground electrode. Electrode lengths shall be as necessary, based on the application and to meet the requirements of the control sequence. A relay switching point shall be provided for each sensor. Contacts shall be rated for a maximum of 240 V_{ac}, 5 A. Switch shall have a maximum response time of 2 seconds. Assembly shall be flange mounted and suitable for the indicated environment.

2.2.3.2 Ultrasonic Sensor

The sensor shall be microprocessor based and shall provide continuous, non-contact level measurement of liquids and solids utilizing microwave pulsed time of flight measurement method. The sensor shall operate in a frequency band approved for industrial use. The sensor shall be capable of measuring in a range of 0 to 20 feet with an accuracy of plus or minus 1 percent of full scale. The sensor shall be capable of distinguishing between real echoes, reflections and background noise. The sensor shall automatically compensate for temperature changes. The sensor shall be capable of operating in a temperature range from minus 0 degrees F to 105 degrees F. Assembly shall be flange mounted, NPT thread (male) of sufficient size to eliminate echoing and suitable for the installed environment indicated. Mounting assembly shall be suitable for service without requiring entry or drainage of the sump where level is being measured.

2.2.3.3 Diesel Fuel Tank Leak Detector

Double walled containment system fuel leak detector shall use sensors mounted in the interstices of double walled containment systems with a minimum time delay of 0.5 seconds. Detector shall have a contact rating of 1.0 amps resistive or 200 mA inductive at 28 V_{dc}. Leak detector panel shall indicate the location and detector causing the alarmed state. The indicator shall be manual reset type.

2.2.4 Pressure Instrumentation

Pressure taps shall incorporate appropriate snubbers. The transmitter shall provide a 4-20 mA_{dc} output signal to the programmable logic controller, proportional to the measured parameter.

2.2.4.1 Pressure Sensor

The sensing element shall be either capsule, diaphragm, bellows, Bourdon tube, or solid state as applicable for the installation. The pressure transducer shall withstand up to 300 percent of rated pressure, with an accuracy of plus or minus 1.0 percent of full scale selected to put the design range of the measured pressure in the middle third of the transducer's range. Pressure shall be measured in pounds per square inch (psi) gage with a range, plus or minus 10 percent of design range and shall be furnished with display to the nearest 0.5 psi. The transmitter output error shall not exceed 0.1 percent of calibrated span.

2.2.4.2 Pressure Switch

Sensors shall be diaphragm or Bourdon tube and shall be constructed of brass. Pressure switch shall have a repetitive accuracy of plus or minus 5.0 percent of the operating range and shall withstand up to 150 percent of rated pressure. Switch actuation set point shall be adjustable over the operating pressure range with a differential adjustment span of 20 to 40 percent of the range of the switch. The switch shall have Form C snap-action contacts rated in accordance with NEMA ICS 1.

2.2.4.3 Differential Pressure

The sensor/transmitter assembly accuracy shall be plus or minus 2 percent of full scale. The over pressure rating shall be a minimum of 300 percent of the operating pressure. Transmitter shall be suitable for installation with the low pressure connection removed.

2.2.4.4 Differential Pressure Switch

Each switch shall be an adjustable diaphragm, or bellows operated device, with taps for sensing lines for connection of pressure fittings designed to sense fluid pressure. For measuring air, gas or vapor stream differential pressure, these fittings shall be of the angled-tip type with tips pointing into the air stream. The adjustable differential range shall be a maximum of 0.5 inches water at the low end to a minimum of 6.0 inches water at the high end. Two Form C contacts rated in accordance with NEMA ICS 1 shall be provided.

2.2.4.5 Pressure and Vacuum Gauges

A. Pressure and Vacuum Gauges: Pressure and vacuum gauges shall be of the local mounting type unless panel mounted type is shown on the Drawings.

B. Construction: Gauges shall be of the bourdon tube or bellows type with 270 degrees and clockwise pointer travel. Dials shall be white with black numerals. Panel-mounted gauges shall have round bezels for flush mounting and rear connection. Others shall have a stem mounting bottom

connection, cast iron case, plastic lens, and blowout protection. Accuracy shall be 1% of full-scale maximum and readable to 1%. Connection for all gauges shall be male 1/4-inch NPT with square wrench flats. Wetted parts shall be corrosion-resistant to the process fluid.

2.2.5 Process Analytical Instrumentation

Probes shall be easily removable without interrupting service. Sampling pumps shall be included where necessary or applicable to the sensing device. For sensors integral to the electronic controller the sample may be drawn directly into the sensor or may be drawn through a sample tube. For sensors remotely located the sample may be drawn through a sample tube.

Outdoor sample tubes shall be heat traced. Sensor and controller construction shall be suitable for operation in the monitored medium. Systems requiring automated zero and calibration gas or reagents shall be provided with 180 days supply of calibration gas or reagent. The controller shall provide a 4-20 mAdc output signal to the programmable logic controller, proportional to the measured parameter. The controller shall be provided with an internal battery to maintain operation for a minimum of 12 hours if power is lost.

2.2.5.1 Fluoride

The fluoride monitor is existing.

2.2.5.2 Chlorine in Liquid

The chlorine residual analyzer is existing.

2.2.5.3 pH Monitoring

The pH monitor is existing.

2.3 PROGRAMMABLE LOGIC CONTROLLER (PLC)

2.3.1 PLC General Requirements

A. PLCs shall be micro-processor based, capable of receiving discrete and analog inputs and, through programming, shall be able to control discrete and analog output functions, perform data handling operations and communicate with external devices. PLCs shall meet the requirements of Class A computing devices, and shall be labeled as set forth in 47 CFR 15 and shall be able to withstand conducted susceptibility test as outlined in NEMA ICS 1, NEMA ICS 2 and NEMA ICS 3. PLCs shall function properly at temperatures between 32 and 122 degrees F at 5 to 95 percent relative humidity non-condensing and shall tolerate storage temperatures between minus 40 and plus 140 degrees F at 5 to 95 percent relative humidity non-condensing.

1. Communication Interfaces: Equip each PLC with a dual communications port and related electronics for connection of the PLC to the redundant data highway. Provide the capability of connecting PLCs to maintenance equipment for troubleshooting.
2. Provide Ethernet communication port.
3. Data Highway Wiring: The wiring shown on the Drawings is

preliminary, pending approval of the PLC.

4. Uninterruptible Power System (UPS): Provide an integral UPS for the PLC. UPS shall be rated to supply entire PLC and I/O loads and field instruments where shown for up to two hours of continuous duty. UPS shall have an input and output power of 120 Vac and shall be mounted within the PLC enclosure.

5. SCADA System Communication Card (AB 1770 KFS).

B. Spare Parts: Provide the following spare parts.

1. One input/output module for each type provided.
2. PLC processor card including memory.
3. PLC input/output communication processor, if applicable.
4. Power supply.

C. Manufacturer: PLC processor shall be Allen-Bradley, SLC 5/XX with compatible components.

2.3.2 Modular PLC

PLCs shall be based on a modular, field expandable design allowing the system to be tailored to the process control application. The system shall be expandable through the use of additional hardware and/or user software. As a minimum, the PLC shall include a mounting backplane, power supply module, central processing unit (CPU) module, communications module, and input/output (I/O) module. The modules shall be grouped together in a mounting rack or cabinet. The mounting rack backplane shall provide the communications mechanism to fully integrate the individual modules located within the rack. Modules shall plug directly into the backplane. The use of wire connectors between modules will not be allowed. The rack size shall be as needed to hold the equipment necessary while performing the required control functions. The system configuration shall allow for the removal and/or installation of modules under power.

2.3.2.1 Central Processing Unit (CPU) Module

The CPU module shall be a self contained, microprocessor based unit that provides time of day, scanning, application (ladder rung logic) program execution, storage of application programs, storage of numerical values related to the application process and logic, I/O bus traffic control, peripheral and external device communications and self diagnostics.

2.3.2.2 Communications Module

The communications module shall allow for peer-to-peer communication with other PLCs and shall allow the PLC to communicate with the EMCS via the local FID/DTC (Siemens Specification Data 144-130). The communication module shall utilize the manufacturer's standard communication architecture and protocol, ethernet architecture and protocol or a combination of these.

The communication module shall allow programming of the PLC to be done locally through the use of a laptop computer or from the central station or remote workstation.

2.3.2.3 Power Supply Module

One or more power supply modules shall be provided as necessary to power other modules installed in the same cabinet. Power supply modules shall plug directly into the backplane. Auxiliary power supplies may be used to supply power to remote cabinets or modules.

- a. Power supply modules shall use AC power with a nominal voltage of 120 vAc plus or minus 5 percent. The power supply module shall monitor the incoming line voltage level and shall provide over current and over voltage protection. If the voltage level is detected as being out of range the power supply module shall continue to provide power for an adequate amount of time to allow for a safe and orderly shutdown. Power supply modules shall be capable of withstanding a power loss for a minimum of 20 milliseconds while still remaining in operation and providing adequate power to all connected modules.
- b. Each power supply module shall be provided with an on-off switch integral to the module. If the manufacturer's standard power supply module is not provided with an on-off switch, a miniature toggle type switch shall be installed near the PLC and shall be clearly labeled as to its function.
- c. Power supply modules shall be provided with an indicating light which shall be lit when the module is operating properly.

2.3.2.4 Input/Output (I/O) Modules

Modules shall be self contained, microprocessor based units that provide an interface to field devices. The module shall be located in the same mounting rack as the other PLC components. The unit shall plug directly into the backplane of the mounting rack. Each module shall contain visual indication to display the on-off status of individual inputs or outputs.

2.3.3 Program Storage/Memory Requirements

The CPU shall utilize the manufacturer's standard non-volatile memory for the operating system. The controller shall have electronically erasable, programmable, read only memory (EEPROM) for storage of user programs and battery backed RAM for application memory. The EEPROM shall be loaded through the controller keypad, central station or through the use of a laptop computer. The CPU memory capacity shall be based on the system's control requirements. The memory capacity shall be sized such that, when the system is completely programmed and functional, no more than 50 percent of the memory allocated for these purposes is used.

2.3.4 Input/Output Characteristics

Each controller shall allow for analog input, analog output, discrete input and discrete output. The number and type of inputs and outputs for the system shall be as shown on the drawings and shall comply with the sequence of control. The system capacity shall include a minimum of 20 percent spare input and output points (no less than two points) for each point type provided. During normal operation, a malfunction in any input/output channel shall affect the operation of that channel only and shall not

affect the operation of the CPU or any other channel. Analog input circuits shall be available in 4-20 mA. Discrete input circuits shall be available in 79-132 vAc. All input circuits shall have a minimum optical isolation of 1500 VRMS and shall be filtered to guard against high voltage transients from the externally connected devices. Analog output circuits shall be available in 4-20 mA. Discrete output circuits shall be available in 79-132 vAc. All output circuits shall have a minimum optical isolation of 1500 VRMS and shall be filtered to guard against high voltage transients from the externally connected devices.

2.3.5 Wiring Connections

Wiring connections shall be heavy duty, self lifting, pressure type screw terminals to provide easy wire insertion and secure connections. The terminals shall accept two #14 AWG wires. A hinged protective cover shall be provided over the wiring connections. The cover shall have write-on areas for identification of the external circuits.

2.3.6 On-Off Switch

Each controller shall be provided with an integral on-off power switch. If the controller is not provided with a manufacturer's standard on-off switch, a miniature toggle type switch shall be installed in the control panel near the controller and shall be clearly labeled as to its function.

2.3.7 Diagnostics

Each PLC shall have diagnostic routines implemented in firmware. The CPU shall continuously perform self-diagnostic routines that will provide information on the configuration and status of the CPU, memory, communications and input/output. The diagnostic routines shall be regularly performed during normal system operation. A portion of the scan time of the controller shall be dedicated to performing these housekeeping functions. In addition, a more extensive diagnostic routine shall be performed at power up and during normal system shutdown. The CPU shall log input/output and system faults in fault tables which shall be accessible for display. When a fault affects input/output or communications modules the CPU shall shut down only the hardware affected and continue operation by utilizing the healthy system components. All faults shall be annunciated at the PLC. Diagnostic software shall be useable in conjunction with the portable tester.

2.3.8 Accuracy

Controllers shall have an accuracy of plus or minus 0.25 percent of input span.

2.4 PLC SOFTWARE

All PLC software described in this specification shall be furnished as part of the complete control system.

2.4.1 Operating System

Each PLC shall be provided with the manufacturer's standard operating system software package. The PLC shall maintain a point database in its memory that includes all parameters, constraints and the latest value or status of all points connected to the PLC. Execution of the PLC application programs shall use the data in memory resident files. The operating system shall support a full compliment of process control functions. It shall be possible to define these functions using a mix of function blocks, ladder logic diagrams, sequential function charts and text programming. Programming methods and interactions shall be based on IEC 1131-3. A combination of the programming methods shall be possible within a single controller. The operating system shall allow loading of software and data files locally. It shall also support data entry and diagnostics using an operator interface panel. Each PLC shall be capable of operating in stand alone mode.

2.4.1.1 Startup

The PLC shall have startup software that causes automatic commencement of operation without human intervention, including startup of all connected I/O functions. A PLC restart program based on detection of power failure at the PLC shall be included in the PLC software. The restart program shall include start time delays between successive commands to prevent demand surges or overload trips.

2.4.1.2 Failure Mode

Upon failure for any reason, each PLC shall perform an orderly shutdown and force all PLC outputs to a predetermined (failure mode) state, consistent with the failure modes shown and the associated control device.

2.4.2 Functions

The controller operating system shall be able to scan inputs, control outputs, and read and write to its internal memory in order to perform the required control as indicated in the sequence of control on the drawings. The controller shall periodically perform self diagnostics to verify that it is functioning properly.

2.4.2.1 Analog Monitoring

The system shall measure and transmit all analog values including calculated analog points.

2.4.2.2 Logic (Virtual)

Logic (virtual) points shall be software points entered in the point database which are not directly associated with a physical I/O function. Logic (virtual) points shall be analog or digital points created by calculation from any combination of digital and analog points, or other data having all the properties of real points, including alarms, without the associated hardware. Logic (virtual) points shall be defined or calculated and entered into the database by the Contractor. The calculated analog point shall have point identification in the same format as any other analog point.

2.4.2.3 State Variables

If an analog point represents more than two (up to 8) specific states, each state shall be nameable. For example, a level sensor shall be displayed at its measured engineering units plus a state variable with named states usable in programs or for display such as low alarm/low/normal/high/high alarm.

2.4.2.4 Analog Totalization

Any analog point shall be operator assignable to the totalization program. Up to eight analog values shall be totalized within a selectable time period.

2.4.3 Alarm Processing

Each PLC shall have alarm processing software for AI, DI, and PA alarms for all real and virtual points connected to that PLC.

2.4.3.1 Digital Alarms

Digital alarms are those abnormal conditions indicated by DIs as specified and shown. The system shall automatically suppress analog alarm reporting associated with a digital point when that point is turned off.

2.4.3.2 Analog Alarms

Analog alarms are those conditions higher or lower than a defined value, as measured by an AI. Analog readings shall be compared to predefined high and low limits, and alarmed each time a value enters or returns from a limit condition. Unique high and low limits shall be assigned to each analog point in the system. In control point adjustment (CPA) applications, key the limit to a finite deviation traveling with the setpoint. The system shall automatically suppress analog alarm reporting associated with an analog point when that analog point is turned off.

2.4.3.3 Pulse Accumulator (PA) Alarms

Pulse accumulator alarms are those conditions calculated from totalized values of accumulator inputs or PA input rates that are outside defined limits as specified and shown. PA totalized values shall be compared to predefined limits and alarmed each time a value enters a limit condition. Unique limits shall be assigned to each PA point in the system.

2.4.4 Constraints

2.4.4.1 Equipment Constraints Definitions

Each control point in the database shall have PLC resident constraints defined and entered by the Contractor, including as applicable: maximum starts (cycles) per hour; minimum off time; minimum on time; high limit (value in engineering units); and low limit (value in engineering units).

2.4.4.2 Constraints Checks

All control devices connected to the system shall have the PLC constraints checked and passed before each command is issued. Each command point shall have unique constraints assigned. High and low "reasonableness" values or one differential "rate-of-change" value shall be assigned to each AI. Each individual point shall be capable of being selectively disabled by the operator from the central station.

2.4.5 Control Sequences and Control Loops

Specific functions to be implemented are defined in Section 13410, and shall include, as applicable, the following functions: PI control shall provide proportional control and proportional plus integral control; two position control shall provide control for a two state device by comparing a set point against a process variable and an established dead band; floating point control shall exercise control when an error signal exceeds a selected dead band, and shall maintain control until the error is within the dead band limits; signal selection shall allow the selection of the highest or lowest analog value from a group of analog values as the basis of control and shall include the ability to cascade analog values so that large numbers of inputs can be reduced to one or two outputs; signal averaging shall allow the mathematical calculation of the average analog value from a group of analog values as the basis of control and shall include the ability to "weight" the individual analog values so that the function output can be biased as necessary to achieve proper control; reset function shall develop an AO based on up to two AIs and one operator specified reset schedule.

2.4.6 Command Priorities

A scheme of priority levels shall be provided to prevent interaction of a command of low priority with a command of higher priority. Override commands entered by the operator shall have higher priority than those emanating from applications programs.

2.4.7 Resident Application Software

The Contractor shall provide resident applications programs developed in accordance with paragraph Graphical Object Oriented Programming to achieve the sequences of operation, parameters, constraints, and interlocks necessary to provide control of the process systems connected to the control system. All application programs shall be resident in the PLC and shall execute in the PLC, and shall coordinate with each other, to insure that no conflicts or contentions remain unresolved.

2.4.7.1 Program Inputs and Outputs

The Contractor shall use program inputs listed for each application program to calculate the required program outputs. Where specific program inputs are not available, a "default" value or virtual point appropriate for the equipment being controlled and the proposed sequence of operation shall be provided to replace the missing input, thus allowing the application program to operate.

2.4.7.2 Failure Mode

In the event of a PLC failure, the controlled equipment shall continue to function in the failure mode shown on the drawings.

2.5 CONTROL PANELS

2.5.1 Components

2.5.1.1 Enclosures

The enclosure for each control panel shall conform to the requirements of NEMA 250 for the types specified. Finish color shall be the manufacturer's standard, unless otherwise indicated. Damaged surfaces shall be repaired and refinished using original type finish. Enclosures for installation in electrical/mechanical equipment rooms shall be Type 12; those for installation in clean, dry indoor occupied space may be Type 1; other locations shall be as otherwise specified or shown. Enclosures for equipment installed outdoors shall be Type 4 or as shown. Enclosures for installation in a corrosive environment shall be Type 4X and shall be constructed of fiberglass or polymer plastic. Painted steel shall not be allowed for use in a corrosive environment. Enclosure shall be provided with a single, continuously hinged exterior door with print pocket, 3-point latching mechanism and key lock and a single, continuously hinged interior door.

2.5.1.2 Controllers

Controllers shall be in accordance with paragraph Programmable Logic Controller (PLC).

2.5.1.3 Standard Indicator Light

Indicator lights shall comply with NEMA ICS 1, NEMA ICS 2 and UL 508. Lights shall be heavy duty, round and shall mount in a 0.875 inch mounting hole. Indicator lights shall be LED type and shall operate at 120 vAc or 24 vDc. Long life bulbs shall be used. Indicator light shall be provided with a legend plate labeled as shown on the drawings. Lens color shall be as indicated on the drawings. Lights shall be push to test (lamp) type.

2.5.1.4 Selector Switches

Selector switches shall comply with NEMA ICS 1, NEMA ICS 2 and UL 508. Selector switches shall be heavy duty, round and shall mount in a 0.875 inch mounting hole. The number of positions shall be as indicated on the drawings. Switches shall be non-illuminated. Switches shall be rated for 600 volts, 10 amperes continuous. Selector switches shall be provided with a legend plate labeled as shown on the drawings. Where indicated or required, dual auxiliary contacts shall be provided for the automatic position to provide position sensing at the central station or workstation.

Auxiliary contacts shall be rated for 120 vAc, 1A as a minimum.

2.5.1.5 Push Buttons

Push buttons shall comply with NEMA ICS 1, NEMA ICS 2 and UL 508. Push buttons shall be heavy duty, round and shall mount in a 0.875 inch mounting hole. The number and type of contacts shall be as indicated on the drawings or required by the Sequence of Control. Push buttons shall be rated for 600 volts, 10 amperes continuous. Push buttons shall be provided with a legend plate labeled as shown on the drawings.

2.5.1.6 Relays

Relays shall comply with IEEE C37.90. Relays shall be as required by the Sequence of Control. Relay coil shall be 120 vAc or 24 vDc and shall be provided with matching mounting socket. Power consumption shall not be greater than 3 watts.

2.5.1.7 Terminal Blocks

Terminal blocks shall comply with NEMA ICS 4 and UL 1059. Terminal blocks for conductors exiting control panels shall be two-way type with double terminals, one for internal wiring connections and the other for external wiring connections. Terminal blocks shall be made of bakelite or other suitable insulating material with full deep barriers between each pair of terminals. A terminal identification strip shall form part of the terminal block and each terminal shall be identified by a number in accordance with the numbering scheme on the approved wiring diagrams.

2.5.1.8 Alarm Horns

Alarm horns shall be provided where indicated on the drawings. Horns shall be vibrating type and shall comply with UL 508. Horns shall provide 100 dB at 10 feet. Exterior mounted horns shall be weather proof by design or shall be mounted in a weather proof enclosure that does not reduce the effectiveness of the horn.

2.5.2 Panel Assembly

Control panels shall be factory assembled and shipped to the jobsite as a single unit. Panels shall be fabricated as indicated and devices shall be mounted as shown or required. Each panel shall be fabricated as a bottom-entry connection point for control system electrical power, control system wiring, communications system wiring to other panels.

2.5.3 Electrical Requirements

Each panel shall be powered by a dedicated 120 volts ac circuit, with a fuse, sized as recommended by the equipment manufacturer, and a disconnect switch located inside the panel. Wiring shall terminate inside the panel on terminal blocks. Electrical work shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR and as shown on the drawings.

2.5.4 Grounding

Control panel enclosures shall be equipped with a solid copper ground bus or equivalent. The ground bus shall be securely anchored to the enclosure

so as to effectively ground the entire structure. Clamp-type terminals sized large enough to carry the maximum expected current shall be provided on the ground bus for grounding cables. Where a definite circuit ground is required, a single wire not less than #10 AWG shall run independently to the panel ground bus and shall be fastened to the ground bus with a bolted terminal lug. Cases of instruments, relays and other devices shall be effectively grounded through the enclosures steel structure unless otherwise indicated. Insulated wiring having a continuous rated current of not less than the circuit fuse rating shall be used for grounding. Grounding terminals of power receptacles shall be solidly grounded to the panel enclosure.

2.5.5 Ventilation System

Each control panel shall be provided with two single phase, 120 volt ac ventilation fans. Each fan shall supply a minimum of 100 cfm of ventilation air through the enclosure. Each fan shall be provided with a line voltage thermostat. Thermostat setpoints shall be adjustable in a range of 70 to 140 degrees F as a minimum. Each supply and exhaust grille shall contain a filter that is easily removed for cleaning or replacement.

2.6 CENTRAL STATION AND OPERATORS WORKSTATION EQUIPMENT

2.6.1 Uninterruptible Power Supply (UPS)

A self contained UPS suitable for installation and operation in the control panel shall be provided. The unit shall be sized to provide a minimum of 10 minutes of operation of the PLC, OI, FID/DTC and instruments (1000 vA/700w minimum). The UPS shall incorporate surge suppression, noise filtering (normal and common mode) short circuit protection and voltage regulation (brownout and overvoltage protection). UPS shall be complete with all necessary power supplies, transformers, batteries, and accessories and shall include visual indication of normal power operation, UPS operation, abnormal operation and visual and audible indication of low battery power. The UPS shall comply with the Federal Communications Commission Standard 15J part A for radio noise emissions.

2.7 USER INTERFACE

2.7.1 Graphical Operations

2.7.1.1 Operator User Interface (OI)

The control panel shall be provided with an object-oriented, touch screen driven, graphical user interface. The graphical user interface shall include a set of utilities including the following: text editor and icon editor.

2.7.1.2 Display Information

The OI shall display information necessary to support all requirements specified, including: operator commands; alarm notification; reports; system graphics as specified and as shown.

2.7.1.3 System Graphics Implementation

System graphics displays shall be hierarchical displays which integrate dynamic data into the display. System graphics shall reflect actual system configuration. Each system schematic shall be included as a separate display. Different colors, textures, and use of inverted video shall be used for various components and dynamic data. The displays shall include standard and/or custom symbols. A library of callable display symbols containing symbols for all necessary equipment and control devices shall be furnished. Symbols shall conform to ASHRAE Hdbk-IP where applicable. Data associated with a display shall be updated within 5 seconds of the digital status change or the analog change in excess of the analog change differential. Any dynamic data which is not current, due to PLC communications failure, PLC failure, or point out of service, shall be highlighted or flagged.

2.7.1.4 Display Editor

The display editor shall enable the user to create, modify, save and delete displays and symbols. Within the display shall be dynamic fields. The function of linking the dynamic fields with the database shall be handled by a separate software module which shall be executed automatically as the last step of the database generation and modification procedure.

2.7.1.5 Graphical Object Oriented Programming

The system shall include a graphical object oriented programming function which shall be used to create all control sequences utilized in the control panels. This function shall reside in the central station to create, modify, and test software for control panel resident programs. The graphical object oriented programming function shall provide programming elements to be connected together to create a logic diagram. The diagram shall be compilable to produce executable code for the control panel. The graphical object oriented programming function shall include elements necessary to create logic diagrams that represent sequences of operation. Program elements shall be able to be combined into a custom template which can then be used as a standard function. Program checkout and debug facilities shall include display of dynamic and/or simulated system variables and points on the programming screens. The user shall be able to fix or force values of variables to enable program checkout during debugging.

2.7.2 Command Software

2.7.2.1 Operator's Commands

The operator's commands shall provide the means for entry of control and monitoring commands, and for retrieval of information. The operator's commands shall perform such tasks as requesting a display of any digital, analog, or accumulator point, or any group of related points, startup and shutdown selected systems or devices, modifying, adjusting, enabling or defining a point or point parameters.

2.7.3 Alarms

The software shall notify an operator of the occurrence of an alarm condition. Alarm messages shall take precedence over other functions. Operator acknowledgment of one alarm shall not be considered as acknowledgment of any other alarm nor shall it inhibit reporting of subsequent alarms. Alarm data to be displayed and stored shall include: identification of the alarm; date and time; device or sensor type; limit exceeded (if analog); engineering units; current value or status; alarm class; and alarm messages.

2.8 DATA COMMUNICATION REQUIREMENTS

Control system data communications shall support the specified functions and control system configuration shown on the drawings.

2.9 FACTORY TEST

The control system shall be tested at the factory prior to shipment. Written notification of planned testing shall be given to the Government at least 21 days prior to testing, and in no case shall notice be given until after the Contractor has received written Government approval of the test procedures.

2.9.1 Factory Test Setup

The Contractor shall assemble and integrate the factory test setup as specified to prove that performance of the system satisfies all requirements of this project, including system communications requirements in accordance with the approved test procedures. The factory test shall take place during regular daytime working hours on weekdays. Equipment used shall be the same equipment that is to be delivered to the site. The factory test setup shall include the following:

Factory Test

control panel	not less than two control panels: at least one of each type used in the system plus at least one per DTS type
communications circuits	one of each type and speed to be utilized in the proposed system.
I/O functions	sufficient to demonstrate the I/O capability and system normal operation
software	software required for proper operation of the proposed system including application programs and sequences of operation

2.9.2 Factory Test Procedure

Test procedures shall define the tests required to ensure that the system meets technical, operational, and performance requirements. The test

procedures shall define location of tests, milestones for the tests, and identify simulation programs, equipment, personnel, facilities, and supplies required. The test procedures shall provide for testing all control system capabilities and functions specified and shown. The procedures shall cover actual equipment and sequences to be used by the Contractor for the specified project and shall consist of detailed instructions for test setup, execution, and evaluation of test results. The test reports shall document results of the tests. Reports shall be delivered to the Government within 7 days after completion of each test. Surge testing need not be conducted if the Contractor can provide acceptable documented proof that such testing has been satisfactorily demonstrated to the Government with identical surge protection applied. The procedures shall include the following:

	Test Procedure
equipment	block diagram
hardware and software	descriptions
commands	operator commands
I/O functions	test database points with failure modes
passwords	required for each operator access level
each type of digital and analog point in the test database	description
test equipment	list
surge protection	circuit diagrams
inputs required (I/O point values and status) and corresponding expected results of each set of input values	for each application program
default values	for the application program inputs not implemented or provided for in the contract documents for the application programs to be tested.

2.9.3 Factory Test Report

Original copies of data produced during the factory test, including results of each demonstration procedure, shall be delivered to the Government at the conclusion of the test, prior to Government approval of the factory test. The report shall be arranged so that commands, responses, and data acquired are correlated to allow logical interpretation of the data.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION REQUIREMENTS

3.1.1 Installation

The Contractor shall install system components and appurtenances in accordance with the manufacturer's instructions and shall provide necessary interconnections, services, and adjustments required for a complete and operable system. Instrumentation and communication equipment and cable grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation. The Contractor shall adjust or replace devices not conforming to the required accuracies. Factory sealed devices shall be replaced (rather than adjusted). Wiring in exposed areas, including low voltage wiring, shall be installed in raceways conduit as specified in Division 16 ELECTRICAL.

3.1.1.1 Isolation, Penetrations of Buildings and Clearance from Equipment

Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exteriors shall be made watertight. Holes in concrete, brick, steel and wood walls shall be drilled or core drilled with proper equipment; conduits installed through openings shall be sealed with materials which are compatible with existing materials. Openings shall be sealed with materials which meet the requirements of NFPA 70. Installation shall provide clearance for control-system maintenance. Control system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

3.1.1.2 Device Mounting

Devices shall be installed in accordance with manufacturers' recommendations and as shown. Control devices to be installed in piping shall be provided with required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Any deviations shall be documented by the Contractor and submitted to the Government for approval prior to mounting.

Damaged insulation shall be replaced or repaired after devices are installed to match existing work. Damaged galvanized surfaces shall be repaired by touching up with zinc paint.

3.1.2 Sequences of Operation

The Contractor shall study the operation and sequence of local equipment controls, as a part of the conditions report, and note any deviations from the described sequences of operation on the contract drawings. The Contractor shall make necessary adjustments to make the equipment operate in an optimum manner and shall fully document changes made.

3.2 INSTALLATION OF EQUIPMENT

The Contractor shall install equipment as specified, as shown and as required in the manufacturer's instructions for a complete and fully operational control system.

3.2.1 Control Panels

Control panels shall be located as indicated on the drawings. Devices located in the control panels shall be as shown on the drawings or as needed to provide the indicated control sequences.

3.2.2 Flow Measuring Device

Fluid flow instruments shall be installed in accordance with ASME-18, unless otherwise indicated in the specification. The minimum straight unobstructed piping for the flowmeter installation shall be 10.0 pipe diameters upstream and 5.0 pipe diameters downstream. Meters for gases and vapors shall be installed in vertical piping, and meters for liquids shall be installed in horizontal piping, unless otherwise recommended by the manufacturer or indicated in the specifications.

3.2.2.1 Magnetic Flowmeter

Meter shall be installed in vertical piping so that the flow tube remains full of the process fluid under all operating conditions. A minimum of five pipe diameters straight run upstream of the flowmeter and two pipe diameters straight run downstream of the flowmeter shall be provided.

3.2.3 Level Instruments

3.2.3.1 Conductivity Switch

Level switches shall be installed vertically and in accordance with the manufacturer's instructions. Switches shall be accessible for maintenance and calibration. In applications where switches cannot be directly mounted to a tank by the threaded or flanged connection, a mounting bracket shall be provided for connection to the inside tank wall, maintaining the minimum recommended distance from the tank fill opening.

3.2.3.2 Ultrasonic Sensor

Sensor shall be installed vertically in the top of the tank and in accordance with the manufacturer's instructions. Switches shall be accessible for maintenance and calibration. In applications where switches cannot be directly mounted to a tank by the threaded or flanged connection, a mounting bracket shall be provided for connection to the inside tank wall. Sensor shall be positioned to maximize the return echo signal and minimize vessel obstructions in the sensors line of sight. The minimum recommended distance from the tank fill opening and from the side of the tank shall be maintained .

3.2.4 Pressure Instruments

Pressure sensors and pressure transducers shall be verified by calibration.

All pressure taps shall incorporate appropriate snubbers. Pressure sensors and pressure switches shall have valves for isolation, venting, and taps for calibration. Pressure switches and pressure transducers installed on liquid shall have drains. Pressure transducers, differential pressure

sensors and differential pressure switches shall have nulling valves. Pressure switches shall be adjusted to the proper setpoint and shall be verified by calibration. Switch contact ratings and duty shall be selected for the application.

3.2.5 Enclosures

All enclosure penetrations shall be from the bottom of the enclosure, and shall be sealed to preclude entry of water using a silicone rubber sealant.

3.3 WIRE, CABLE AND CONNECTING HARDWARE

3.3.1 LAN Cables and Connecting Hardware

LAN cables and connecting hardware shall be installed in accordance with Section 16710 PREMISES DISTRIBUTION SYSTEM and Section 16711 TELEPHONE SYSTEM, OUTSIDE PLANT.

3.3.2 Metering and Sensor Wiring

Metering and sensor wiring shall be installed in accordance with the requirements of ANSI C12.1, NFPA 70, Section 16375 ELECTRICAL DISTRIBUTION, UNDERGROUND and Section 16415 ELECTRICAL WORK, INTERIOR.

3.3.2.1 Sensor and Control Wiring Surge Protection

Digital and analog inputs shall be protected against surges induced on control and sensor wiring. Digital and analog outputs shall be protected against surges induced on control and sensor wiring installed outdoors and as shown. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both the normal and common mode using the following two waveforms: The first waveform shall be 10 microseconds by 1000 microseconds with a peak voltage of 1500 volts and a peak current of 60 amperes. The second waveform shall be 8 microseconds by 20 microseconds with a peak voltage of 1000 volts and a peak current of 500 amperes.

3.4 SOFTWARE INSTALLATION

The Contractor shall load software required for an operational control system, including databases (for points specified and shown), operational parameters, and system, command, and application programs. The Contractor shall adjust, tune, debug, and commission all software and parameters for controlled systems to assure proper operation in accordance with the sequences of operation and database tables.

3.5 FIELD TESTING AND ADJUSTING EQUIPMENT

The Contractor shall provide personnel, equipment, instrumentation, and supplies necessary to perform site testing. The Government will witness the PVT, and written permission shall be obtained from the Government before proceeding with the testing. Original copies of data produced, including results of each test procedure, during PVT shall be turned over to the Government at the conclusion of each phase of testing prior to Government approval of the test. The test procedures shall cover actual

equipment and functions specified for the project.

3.5.1 Testing, Adjusting and Commissioning

After successful completion of the factory test as specified, the Contractor will be authorized to proceed with the installation of the system equipment, hardware, and software. Once the installation has been completed, the Contractor shall test, adjust, and commission each control loop and system in accordance with NIST SP 250 and shall verify proper operation of each item in the sequences of operation, including hardware and software. The Contractor shall calibrate field equipment, including control devices, adjust control parameters and logic (virtual) points including control loop setpoints, gain constants, constraints, and verify data communications before the system is placed online. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. The Contractor shall calibrate each instrumentation device connected to the control system control network by making a comparison between the reading at the device and the display at the workstation, using a standard at least twice as accurate as the device to be calibrated. The Contractor shall check each control point within the control system control network by making a comparison between the PLC/OI and field-controlled device. The Contractor shall verify operation of systems in the specified failure modes upon Control system network failure or loss of power, and verify that systems return to control system control automatically upon a resumption of control system network operation or return of power. The Contractor shall deliver a report describing results of functional tests, diagnostics, calibrations and commissioning procedures including written certification to the Government that the installed complete system has been calibrated, tested, adjusted and commissioned and is ready to begin the PVT. The report shall also include a copy of the approved PVT procedure.

3.5.2 Performance Verification Test (PVT)

The Contractor shall prepare test procedures for the PVT. The test procedure shall describe all tests to be performed and other pertinent information such as specialized test equipment required and the length of the PVT. The test procedures shall explain, in detail, step-by-step actions and the expected results, to demonstrate compliance with all the requirements of the drawings and this specification. The test procedure shall be site specific and based on the inputs and outputs, required calculated points and the sequence of control. The Contractor shall demonstrate that the completed Control system complies with the contract requirements. All physical and functional requirements of the project including communication requirements shall be demonstrated and shown. The Contractor shall demonstrate that each system operates as required in the sequence of operation. The PVT as specified shall not be started until after receipt by the Contractor of written permission by the Government, based on the Contractor's written report including certification of successful completion of testing, adjusting and commissioning as specified, and upon successful completion of training as specified. Upon successful completion of the PVT, the Contractor shall deliver test reports and other documentation as specified to the Government.

3.5.3 Endurance Test

The Contractor shall use the endurance test to demonstrate the overall system reliability of the completed system. The endurance test shall be conducted in phases. The endurance test shall not be started until the Government notifies the Contractor in writing that the PVT is satisfactorily completed, training as specified has been completed, outstanding deficiencies have been satisfactorily corrected, and that the Contractor has permission to start the endurance test. The Contractor shall provide an operator to man the system 8 hours per day during daytime operations, including weekends and holidays, during Phase I endurance testing, in addition to any Government personnel that may be made available. The Government may terminate testing at any time when the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period as described for Phase II. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation, as specified, to the Government prior to acceptance of the system.

3.5.3.1 Phase I (Testing)

The test shall be conducted 24 hours per day, 7 days per week, for 2 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized by the Government in writing.

3.5.3.2 Phase II (Assessment)

After the conclusion of Phase I, the Contractor shall identify failures, determine causes of failures, repair failures, and deliver a written report to the Government. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Government. The meeting shall not be scheduled earlier than 5 business days after receipt of the report by the Government. As a part of this test review meeting, the Contractor shall demonstrate that failures have been corrected by performing appropriate portions of the performance verification test. Based on the Contractor's report and the test review meeting, the Government will determine if retesting is necessary and the restart point. The Government reserves the right to require that the Phase I test be totally or partially rerun. The Contractor shall not commence any required retesting until after receipt of written notification by the Government. After the conclusion of any retesting which the Government may require, the Phase II assessment shall be repeated as if Phase I had just been completed.

3.5.3.3 Exclusions

The Contractor will not be held responsible for failures resulting from the following: Outage of the main power supply in excess of the capability of any backup power source, provided that the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the control system performed as specified. Failure of a Government

furnished communications link, provided that the PLC automatically and correctly operates in the stand-alone mode as specified, and that the failure was not due to Contractor furnished equipment, installation, or software. Failure of existing Government owned equipment, provided that the failure was not due to Contractor furnished equipment, installation, or software.

3.6 MANUFACTURER'S FIELD SERVICES

The Contractor shall obtain the services of a manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installing, adjusting, and testing of the equipment.

3.7 INSTRUMENTATION AND CONTROL SYSTEM

Control drawings, framed, non-fading half-size in laminated plastic, reproducible, with corresponding CADD files, shall be provided for equipment furnished and for interfaces to equipment at each respective equipment location. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation and procedures for safely starting and stopping the system manually shall be prepared in typed form, framed as specified for the instrumentation and control diagrams, reproducible, with corresponding word processor files and posted beside the diagrams. Diagrams and instructions shall be submitted prior to posting.

3.8 FIELD TRAINING

Field training oriented to the specific system shall be provided for designated personnel. A copy of the training manual for each trainee plus two additional copies shall be delivered to the Contracting Officer. Manuals shall include an agenda, the defined objectives for each lesson, and a detailed description of the subject matter for each lesson. The Contractor shall furnish audiovisual equipment and other training supplies and materials. Copies of the audiovisuals shall be delivered with the printed training manuals. The Government reserves the right to videotape training sessions for later use. A training day is defined as 8 hours of classroom instruction, excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. Approval of the Contractor's training schedule shall be obtained from the Government at least 30 days before the training.

3.8.1 Preliminary Operator Training

Prior to the start of field testing, preliminary operator training shall be taught at the project site for 2 consecutive training days. Upon completion of this course, each student, using appropriate documentation, should be able to perform elementary operations with guidance and describe the general hardware architecture and functionality of the system. This course shall include: general system architecture; functional operation of the system, including workstations; operator commands; application programs, control sequences, and control loops; database entry and modification; reports generation; alarm reporting; diagnostics; and

historical files.

3.8.2 Additional Operator Training

Following the field testing, additional classroom training for operators shall be taught for 1 training day. Individual instruction shall consist of "hands-on" training under the constant monitoring of the instructor. Classroom training shall include instruction on the specific hardware configuration of the installed control system and specific instructions for operating the installed system. The Contractor shall schedule activities during this period so that the specified amount of time on the equipment will be available for each student. The final session will address specific topics that the students need to discuss and to answer questions concerning the operation of the system. Upon completion of the course, the students should be fully proficient in system operation and have no unanswered questions regarding operation of the installed control system. Each student should be able to start the system, operate the system, recover the system after a failure and describe the specific hardware architecture and operation of the system and be fully proficient in all system operations. The Contractor shall report the skill level of each student at the end of this course.

3.8.3 Maintenance Training

Following the endurance test, a minimum period of 1 training day shall be provided by a factory representative or a qualified Contractor trainer for ten designated personnel on maintenance of the equipment. The training shall include: physical layout of each piece of hardware, calibration procedures, preventive maintenance procedures, schedules, troubleshooting, diagnostic procedures and repair instructions.

3.8.4 Specialized Training

3.8.4.1 Flow Meter Training

Each type of flow meter, to include calibration, maintenance and testing of flow elements and transducers.

3.8.4.2 Specialized Sensor Training

Each type of specialized sensor such as chlorine, pH and fluoride to include calibration, maintenance and testing of sensing elements and transducers.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13410

CONTROL STRATEGIES

03/01

PART 1 GENERAL

- 1.1 SECTION INCLUDES
- 1.2 SUBMITTALS

PART 2 CONTROL STRATEGIES

- 2.1 GENERAL SYSTEM DESCRIPTION
- 2.2 PLC CONTROL STRATEGY - GENERAL REQUIREMENTS
- 2.3 PLC PROGRAMMING - SPECIFIC LOOP REQUIREMENTS
- 2.4 OPERATOR INTERFACE UNIT
- 2.5 CENTRAL COMPUTER AND LOCAL RTU PROGRAMMING

PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 13410

CONTROL STRATEGIES

03/01

PART 1 GENERAL

1.1 SECTION INCLUDES

Scope: The work under this section includes the control strategies to be utilized by the equipment installed or modified under this project. This includes, but is not limited to, programming requirements for the programmable logic controller. The programming of the programmable logic controller (PLC) and operator interface unit (OI) unit shall include all new and future equipment. Future equipment will be on separate OI screens and not be confusing given the current process as provided. Reference Section 13405 for hardware requirements.

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Ladder Logic/Program; GA.

Screens; GA.

PART 2 CONTROL STRATEGIES

2.1 GENERAL SYSTEM DESCRIPTION

The following description is a general narrative of the water treatment plant operation beginning with the existing wells, through the plant and to the three million-gallon (MG) storage tank.

The Beale AFB Water Treatment Plant consists of the following major components:

Existing Well Water Supply (loops 1 - 9) (off site)

Influent Pressure Reducing Assembly (loop 11)
Booster Pump Station (loops 12, 21, 22 and 23)
Chemical Feed Systems (loops 13 and 14)
Aerator (loop 24)
Chlorine Residual (loop 40)
Fluoride Residual (loop 41)

pH Monitor (loop 42)
Power, Generator, ATS, Diesel Tank Monitor (loop 43, 44 and 45)
Pressure Filters (loops 29 - 51)
Backwash System (loops 60, 61, 70 and 11)
System Pressure (loop 80)

Existing 3-MG Treated Water Storage Tank (off site)

Existing Base wide EMCS system (off site)

Communication with Local FID/DTC (RTU)

Groundwater containing entrained gases, iron and manganese is pumped from wells to a pressure reducing station where the head is reduced and the water is allowed to discharge into an aerator for removal of gases. The tower discharges to a concrete sump into which chlorine is injected to oxidize the iron and manganese prior to filtration. Water is pumped from the concrete sump via a booster pump station to three pressure filters where the iron and manganese is removed. The water is discharged from the filters under pressure to a transmission pipeline feeding the 3-MG Treated Water Storage Tank. The 3-MG Tank serves the distribution system.

The well pumps start and stop based on water level in the 3-MG Tank. Flow from the wells is metered before discharge to the aerator. The air blower at the aerator is started and stopped based on flow at the flow meter. Sump level controls the lead and lag booster pump with a high sump level calling the standby pump. The lead pump is equipped with a variable frequency drive (VFD) motor and does not alternate with the lag pump(s). The lead pump speed is modulated to maintain a constant (within a range) sump level. The lag pump is called when there is a rising (high) sump level which the single pump/VFD is unable to accommodate incoming flow. The lag pump is a fixed speed pump. The two pump operating logic is also based on maintaining a constant (within a range) sump level using the VFD. The third pump is a constant speed pump and pumps numbers two and three alternate lag position based on starts/stops. A high/high sump level will initiate an alarm, turn on the standby pump, and register an alarm that sends a signal to the base wide EMCS system to shut off the well pumps.

The plant components can be completely bypassed upstream of the pressure reducing station, partially bypassed upstream of the aerator or partially bypassed upstream of the pressure filters. Chemical feed is configured to address the bypass operation as well as normal operation. Chemical feed includes chlorine and fluoride.

The individual process components are described in more detail below.

Existing Well Water Supply

There are several existing groundwater wells each equipped with constant speed vertical turbine pumps. The wells currently pump groundwater directly to the existing 3-MG Tank in the winter and require booster pumping during the summer demand period to fill the tank. The well pumps are turned on and off based on tank level. The existing 3-MG Tank, wells and vertical turbine pumps will remain. The existing booster pump station

will be abandoned.

The operational control of the wells will remain based on tank level controlled via the base EMCS system. Existing EMCS system modifications include a disable interlock for the wells during a backwash cycle and high/high sump level alarm, and the ability to monitor level in the 3-MG tank at the plant and shut down booster pumps on a high/high level alarm.

New Water Treatment Plant

The new water treatment plant consists of a influent pressure reducing assembly, an aerator, a booster pump station, pressure filters, chemical feed systems, backwash system and control system.

Influent Pressure Reducing Assembly

The existing well pumps provide excess pressure that must be dissipated prior to discharge to the aerator. This is accomplished through a pressure reducing assemble that will maintain a constant downstream pressure regardless of flow. The assembly consists of two hydraulically actuated diaphragm valves in series. Two valves in series are required to prevent cavitation due to the large inlet to outlet pressure differential that would exist if a single valve was used. A plant bypass valve and pipeline upstream of the pressure reducing assembly allows well water to be pumped directly to the 3-MG Tank, bypassing the entire water treatment plant. Chlorine disinfection and fluoridation can be provided during this bypass mode of operation.

Aerator

The water passing through the pressure reducing assembly enters an aerator for the removal of hydrogen sulfide, carbon dioxide and methane present in the groundwater. Stripping occurs as the water cascades through a vertical tank filled with irregularly shaped plastic media. The plastic media is designed to disrupt the water flow and maximize air/water surface contact. A blower provides forced ventilation, driving fresh air through the aerator and stripping gas entrained in the water. A propeller type flow meter with remote indication located downstream of the pressure reducing assembly controls the aeration tower blower and the chemical feed systems. The blower is started based on flow at the influent meter. The blower stop signal is also controlled on flow with an adjustable delay to allow it to continue to run after the flow has stopped until the aerator has completely drained.

Aerated water is discharged by gravity into a concrete sump below the aerator. The aerator has a bypass valve and piping to allow water to be pumped directly into the aerated water sump.

Booster Pump Station

The booster pump station includes the concrete aerated water sump that provides both chemical contact time and a reservoir from which to pump. The pumps consist of three (3) vertical turbine booster pumps. The lead pump is a variable frequency drive (VFD) pump that modulates flow based on

sump level. The lag pump and standby pump make up the balance of the pumps. They are both fixed speed pumps and they alternate status based on start/stop sequence.

The variable speed pump will maintain a constant sump level and match the influent flows from the wells. A decreasing 3-MG tank level will call additional well pumps and can exceed the full speed capacity of the lead pump. When this occurs, the sump level will rise and the lag pump will come on. Operation will continue with the VFD controlling sump level. The lag pump will operate until a low sump level turns it off. The variable speed pump will turn off on a second low level setting. The standby pump will be called if a high-level alarm condition occurs in the sump.

The booster pump effluent provides supply to the pressure filters and the filter surface wash used during the backwash startup cycle.

A filter bypass valve and piping is provided to allow pumping directly from the booster pump station to the 3-MG Tank transmission main.

Pressure Filters

The pressure filters consist of three steel pressure vessels partially filled with granular media designed for the removal of oxidized iron and manganese from the water. The three filters operate in parallel with each filter processing one third of the supply volume under normal operation. The filters are cleaned by backwashing one at a time until all three are cleaned. The distribution system supply is used for backwash. The surface wash is supplied from the booster pump station VFD at a higher head upstream of the filters. Backwash can be initiated on differential pressure across the filter (headloss), filter run time, and elapsed time since the last backwash. A time-of-day feature can prevent a backwash during high demand periods.

Chemical Feed Systems

The chemical feed systems consist of onsite generated sodium hypochlorite (chlorine) and fluoride facilities. The existing chlorine system from building 701 is being relocated and incorporated into the new water treatment plant process.

Chlorine can be injected at up to three locations including upstream of the aerator, at the aerated water sump, and at the treated water effluent pipeline under a full plant bypass condition. Chlorine injection upstream of the aerator is for biological growth control within the tower and is not expected to be needed under normal conditions. Chlorine is injected into the aerated water sump as an oxidant for treatment and disinfectant for residual in the distribution system. The chlorine feed rate is paced based on flow and chlorine residual present at the filtered water effluent pipeline leaving the plant using a compound loop control strategy. The third chlorine injection point is at the filtered water pipeline leaving the site and is for disinfection and residual during a plant bypass mode of operation

Fluoride is injected into the treated water flow downstream of the filters.

During normal operations the sample tap point will be adjacent to the control building in the effluent piping. In the by-pass mode of operation the sample tap point is moved to the chemical injection vault.

Backwash System

The backwash system consists of a wash water supply, surface wash water supply, rinse water supply, backwash storage tank, washwater return pipeline from the tank to the aerated water sump and associated valves. One backwash cycle cleans all three filters with each filter cleaned individually until all filters are washed. A filter rinse cycle completes the backwash once all filters have been cleaned. The filters are placed back in service following the rinse cycle.

Backwashing starts with all influent valves closed and the backwash effluent valve of the first filter to be washed opened to allow flow to pass up through the filter and to the backwash water recovery tank. A surface wash is initiated during the first part of the wash cycle. This agitates the top of the filter media bed and enhances cleaning. The surface wash duration is adjustable. The backwash rate is also adjustable to allow ramping up and down of the flow volume to control the fluidization of the beds, the cleaning action, and segregation of the media following cleaning.

The second and third filters are backwashed sequentially similar to the first filter. A rinse cycle is initiated once all filters have been cleaned using the booster pumps for supply. The rinse time is adjustable and allows the filter to flush any residual material prior to putting the filter back in service. The rinse water is pumped in a loop and returned to the aerated water sump following rinse.

The backwash water supply is provided from the 3-MG Tank transmission pipeline. The surface wash supply comes from the booster pump station upstream of the filters and is at a higher pressure than the backwash supply. Surface wash supply is provided by the VFD pump and will be inoperable if the VFD is off-line. The rinse water also comes from the booster pumps.

Specific operating conditions must be satisfied before a backwash will initiate. The primary backwash initiation criterion includes filter run time, elapsed time, and differential pressure set points. The additional criteria include a time of day lockout to prevent a backwash from occurring during a peak demand period; a minimum 3-MG tank level lockout to avoid a backwash under a low tank level; and a backwash tank high level lockout to avoid overflowing the backwash water tank.

Spent backwash water is discharged to the backwash tank. Backwash water is recycled through solids settling and decanting the clarified water back to the aerated water sump. Decanted water is metered into the sump at a maximum rate of ten percent of the plant influent flow rate. Solids are periodically discharged from the tank to the sewer for disposal.

Treated Water Storage

The existing 3-MG Tank becomes the treated water storage tank. Piping improvements will create a dedicated transmission line for treated water to the tank and separate discharge line from the tank to the distribution system. This regulated flow through the tank will help maintain a chlorine residual in the tank and distribution system.

THE EXISTING TANK LEVEL INDICATOR AND CONTROLS WILL REMAIN AS IS TO CONTROL THE WELL PUMPS. A NEW INTER-LOCK WILL BE PROVIDED FOR THE BOOSTER PUMPS TO PREVENT OVERFLOWING THE TANK ON HIGH LEVEL.

2.2 PLC CONTROL STRATEGY - GENERAL REQUIREMENTS

The control descriptions, together with the block diagrams, comprise the functional design criteria of the programmable controllers (PLC).

Provide manual start/stop capabilities for all pumps/aerators interfaced with the PLC.

Provide a feedback fail alarm for all equipment interfaced with the PLC. The PLC-based fail alarm shall be initiated if a pump is commanded to start/stop by the PLC and the appropriate run or speed status feedback signal is not received within an adjustable time delay.

Provide PLC-based elapsed time meters (ETMs) for all pumps and aerators interfaced with the PLC.

All control parameters and alarms shall contain adjustable setpoints, deadbands and timers, as applicable, and be easily modifiable at the operator interface unit. All inputs, outputs, setpoints, timers and other control and monitoring parameters shall be viewable and modifiable, when applicable, locally by the operator interface unit. The level signal shall be frozen for 30 seconds (adjustable from 0-5 minutes) whenever any pump starts or stops and during a purge cycle.

Pumps and aerators shall not be called by the PLC when in the OFF or HAND modes or when not available because of a fault or not meeting any other standby criteria. If a pump or aerator fails to respond to a pump call or a speed call, it shall be failed by the PLC and an alarm shall occur. The PLC shall attempt to reset a failed VFD three times before passing the fault condition to the local FID/DTC. Provide an adjustable pump start time delay for all pumps and aerators.

In the manual mode of operation the lead Booster Pump VFD shall be called to start by the hand mode of the HAND-OFF-AUTO selector switch and speed shall be controlled by the manual speed adjustment device on the face of the VFD cubicle. The PLC shall monitor the pump/VFD but will not control it. All protective features in this mode shall be hardwired or internal to the VFD logic. Reset functions will be manual.

In auto mode of operation the pump VFD shall be called to start by the PLC and speed shall be controlled by the PLC based upon the level in the sump and the combination of pumps running. Enable/disable function

above and beyond the hardwired functions shall be controlled by the PLC. Alarms and reset functions shall be controlled by the PLC.

Other alarm and control functions.

All alarms shall be annunciated by the common alarm indicator light and operator interface unit. Alarms shall be reset by the ALARM RESET pushbutton on the operator interface unit. All alarms shall be transmitted to the central computer via the base EMCS system and local FID/DTC (RTU).

An intrusion alarm shall occur after any door is opened and a timer has timed out and an intrusion system reset has not occurred.

Power failure and UPS failure shall alarm.

Controller failure shall alarm.

A manual purge cycle shall be started when the PURGE pushbutton is pushed on the operator interface unit. The PLC shall periodically call for a automatic purge cycle and freeze the analog level internally.

2.3 PLC PROGRAMMING - SPECIFIC LOOP REQUIREMENTS

A. General Equipment Interface

1. General: This strategy describes typical interface logic with final control elements such as pumps, blowers, valves, and other equipment.

2. Description: The PLC shall monitor the equipment's related inputs/outputs and the operator interface unit will communicate information, as follows:

a. If equipment is in "ready" mode and required, the PLC shall activate a normally open discrete output "DO" to call the equipment to start.

b. The PLC shall monitor the "READY" and "RUN" discrete inputs from starter controls.

c. If the "RUN" input is not activated within an adjustable time period of ($t = 15$ seconds), the PLC shall fail the equipment, revoke the call command and the OI shall annunciate an equipment "FAILED" condition.

d. The Filter Control Panel FCP Operator Interface Unit OI shall indicate the equipment "RUN," "READY," and "FAIL" status as applicable.

3. Equipment Alternation: For two or more pieces of equipment of the same function, the PLC shall alternate their alternation in one of the following manners based upon input from the OI.

a. Manual: The "lead" piece of equipment is assigned and will continue to run unless it fails or process conditions require the "lag" or "standby" equipment to run. In the next cycle of operation, the same equipment continues the same assignment unless manually reassigned.

b. Automatic (Last Off): The equipment alternate based on the process cycle where after each cycle the PLC switches the sequence to equalize the run time.

4. Automatic Valve Interface: The interface includes controlling and monitoring the valves of the types described herein. The PLC shall activate the DO when the equipment is in the "Backwash" mode only.
 - a) Valves: These types typically are valves used for open/close service. To open or close the valve, the PLC shall energize a D.O. contract.
 - b) Flow Control Valves: Several valves will require a modulating signal to open or close. The modulating signal may be either a pulsing digital output or a 4-20 mA analog signal (see the Process & Instrumentation Diagrams)
 5. Operator Interface (OI) Unit:
 - a. Touch screen handswitches are used to select modes and initiate control sequences.
 - b. All operator actions are to be provided with feedback to PLC and indication at the OI. The "READY," "RUN," status indications are example of appropriate feedback.
 - c. Process variable shall be available for viewing where required by loop description.
 - d. Setpoint adjustments must be directly accessible to the operator via the operator interface.
 6. Typical Alarms:
 - a. General: This strategy describes the monitoring and display of alarm conditions. The alarm conditions can be 1) Discrete input, 2) Derived, and 3) Deviation.
 - b. Discrete Input: Whenever a discrete input alarm is detected, the PLC shall annunciate an alarm after an adjustable 0 to 5 seconds.
 - c. Derived Alarms: A derived alarm consists of monitoring of analog inputs and/or logic derivation with control strategies: comparison of an analog input and a setpoint. The PLC monitors these events and annunciate alarms after an adjustable delay of 0 to 5 seconds.
- B. Well Pumps Control (loops 1-9)
1. General: Existing well pumps provide approximately 3500 GPM (5 MGD) of raw ground water to the aerated water sump via the aerator, or directly to the sump via the aerator bypass, or directly to the storage tank via the plant bypass.
 2. System Interface:
 - a. The existing EMCS system controls the well pumps.
 - b. Send a EMCS system signal to the local Siemens RTU to shut down/ disable all well pumps on a high/high sump level or during backwash. The Siemens EMCS system will be programmed to disable the pumps (see loop description 12).
 3. Non-PLC Controls:
 - a. Existing control via the Siemens EMCS system.
 4. PLC Based Controls
 - a. Pumps disabled based on high/high sump level (PLC setpoint based on analog input or level switch). After a high/high level event pumps enabled based on low sump level (PLC setpoint based upon analog input).
 - b. Pumps disabled during backwash. Pumps enabled after completion of backwash operations.
 5. Monitoring and indicate:

- a. Well Pumps Disabled condition (OI)
 - 6. Alarms:
 - a. None required.
- C. Raw Ground Water Flow (Loop 11)
 - 1. General: The flow meter provides analog flow signal to the PLC for starting and stopping the aerator and metering pumps, and pacing the metering pumps.
 - 2. System Interface:
 - a. Automatic control of Aerator Blower.
 - b. Automatic control of Chlorine Metering Pumps.
 - c. Pacing of Chlorine Metering Pumps.
 - d. Setpoints inputs via the OI unit.
 - 3. Non-PLC Controls:
 - a. None
 - 4. PLC Based Controls
 - a. Aerator Blower call based on minimum flow (PLC setpoint)
 - b. Aerator Blower call revoked based upon flow (an adjustable amount) below minimum flow after an adjustable time delay (PLC setpoints)
 - c. Chlorine Metering Pumps call based on minimum flow (PLC setpoint).
 - d. Chlorine Metering Pumps call revoked based upon flow (an adjustable amount) below minimum flow (PLC setpoint)
 - e. Chlorine Metering Pumps pacing signals based upon a conditioned output (Compound control loop and PID control loop - see loop descriptions 13 & 42).
 - f. Backwash decant control (see loop description 51).
 - 5. Monitoring and indicate:
 - a. Raw Ground Water Flow and totalized flow (OI).
 - 6. Alarms:
 - a. High flow alarm (PLC setpoint).
- D. Booster Pump No. 1, No. 2 and No. 3 and Level Controls (loops 12, 21, 22 and 23)
 - 1. General: One Booster Pump is equipped with a variable frequency drive and two Booster Pumps are equipped with reduced voltage starting (RVSS starters). Each pump provides up to 1750 GPM to the 3-MG Tank. The Pump controls will be such as to maintain a constant sump level (within a range) setting via the programmable logic controller. Essentially inflow from the well will equal outflow to the tank. The VFD driven Booster Pump will also provide surface wash water from the sump. Surface wash is part of the backwash sequence. Backwash events shall not occur when system pressure is low (see loop description 70).
 - 2. System Interface:
 - a. Well Pump Disable. Send a EMCS system signal to the local Siemens FID/DTC (RTU) to shut down/ disable all well pumps on a high/high sump level or during backwash. The Siemens EMCS system will be programmed to disable the pumps (see loop descriptions 1-9).
 - b. Filter surface wash control.
 - c. Setpoints inputs via the OI unit.
 - 3. Non-PLC Based Controls:
 - a. "HAND-OFF-AUTO" Selector Switches

- b. Local Lock Out Stop Switches
- c. Manual Speed Control of VFD
- 4. PLC Based Controls:
 - a. Start the lead pump (VFD driven) based upon increasing level in the sump at the Lead Pump Start Setpoint. Control the speed between the Lead Pump Minimum Speed Level Setpoint and the Lead Pump Maximum Speed Level Setpoint based upon the sump level deviation from the Sump Level Control Setpoint.
 - b. Stop lead pump prior to starting backwash sequence and start/run as required to maintain surface wash flow.
 - c. Lag Pump shall be called if Lead Pump cannot maintain the level within its operating range. If the level in the sump rises to Lag Pump Start Setpoint, call the Lag Pump. If the level in the sump decreases to the Lag Pump Stop Setpoint, stop the lag pump.
 - d. Lag - Standby Booster Pump Alternation.
 - e. Booster pumps disabled on low sump level alarm.
 - f. Booster pumps disabled on remote 3-MG Tank High Level (via Siemens EMCS system and local Siemens FID/DTC).
- 5. Level Control:
 - a. As the level increases to the *lead pump start setpoint* the lead pump starts. The lead pump speed shall ramp up to *one pump running minimum speed setpoint*. As the level increases to the *lead pump maximum speed level setpoint* the pump speed shall ramp up to the *one pump running maximum speed setpoint*. The speed call output shall be based upon an algorithm with a level input.
 - b. As the level decreases to the *lead pump stop level setpoint* the lead pump speed shall ramp down proportionally towards the *one pump running minimum speed setpoint*. Once the level reaches the *lead pump stop level setpoint* and *one pump running minimum speed setpoint* a timer shall start. When the timer reaches the *minimum speed maximum time setpoint* the lead pump shall be stopped.
 - c. If the level increases to the *lead pump maximum speed level setpoint* the lead pump speed shall ramp up proportionally towards the *lead pump maximum speed setpoint*. If the level reaches the *lag pump start level setpoint* the lag pump shall be called to start. The lead pump speed shall ramp down to the *two pumps running minimum speed setpoint*. As the level increases to the *two pump running maximum speed level setpoint* the lead pump speed shall ramp up to the *two pump running maximum speed setpoint*. The speed call output shall be based upon an algorithm with a level input.
 - d. As the level decreases to the *lag pump stop level setpoint* the lead pump speed shall ramp down proportionally towards the *two pumps running minimum speed setpoint*. Once the level reaches the *lag pump stop level setpoint* and *lead pump reaches the two pump minimum speed setpoint* a timer shall start. When the timer reaches the *minimum speed maximum time setpoint* the lag pump shall be stopped the lead pump will ramp up.
 - e. If the level continues to increase to the *high level setpoint* or the *high level float switch level* a high level alarm shall.
 - f. A low level alarm shall occur when the level fall to the *low level alarm setpoint*.

- g. Well pumps disabled based on high/high sump level (PLC setpoint based on analog input or level switch). Pumps enabled based on low sump level (PLC setpoint based upon analog input).
 - h. Well pumps disabled during backwash.
 - 6. Monitoring and indicate for each pump:
 - a. Pump Run and Speed Status (OI and MCC).
 - b. Pump Run Times (OI and MCC).
 - c. Pump in Auto Mode Status (OI and MCC).
 - d. Lag Pump (OI).
 - 7. Alarms:
 - a. Pump Call to Run Failure.
 - b. Pump Motor High Temperature.
- E. Chlorine Feed System Control (Loops 13)
 - 1. General: Start, stop and pace Chlorine Metering Pumps.
 - 2. System Interface:
 - a. Automatic control of Chlorine Metering Pumps.
 - b. Chlorine Metering Pump VFDs.
 - c. Setpoints inputs via the OI unit.
 - 3. Non-PLC Controls:
 - a. Chlorine generation system.
 - b. Chlorine Metering Pump VFDs.
 - c. Manual control of pumps.
 - 4. PLC Based Controls
 - a. Plant in "BYPASS" mode (from selector switch).
 - b. Chlorine Metering Pumps call based on minimum flow (PLC setpoint).
 - c. Chlorine Metering Pumps call revoked based upon flow (an adjustable amount) below minimum flow (PLC setpoint).
 - d. Chlorine Metering Pumps pacing signals based upon a conditioned output Compound control loop with raw water flow being the feed-forward portion and residual being the feedback portion when the plant is in "AUTO" mode and PID feedback control (residual only) when the plant is in "BYPASS" mode (see loop descriptions 11 & 40).
 - 5. Monitoring and indicate:
 - a. Chlorine Metering Pump(s) Running (from VFDs)
 - 6. Alarms:
 - a. VFD Fail
- F. Fluoride Feed System Control (Loops 14)
 - 1. General: Start, stop and pace Fluoride Metering Pumps.
 - 2. System Interface:
 - a. Automatic control of Fluoride Metering Pumps.
 - b. Setpoints inputs via the OI unit.
 - 3. Non-PLC Controls:
 - a. Manual control of pumps.
 - 4. PLC Based Controls
 - a. Plant in "BYPASS" mode (from selector switch).
 - b. Fluoride Metering Pumps call based on minimum flow (PLC setpoint).
 - c. Fluoride Metering Pumps call revoked based upon flow (an adjustable amount) below minimum flow (PLC setpoint).
 - d. Fluoride Metering Pumps pacing signals based upon a

conditioned output Compound control loop with treated water flow being the feed-forward portion and residual being the feedback portion when the plant is in "AUTO" mode and PID feedback control (residual only) when the plant is in "BYPASS" mode (see loop descriptions 41 & 60).

5. Monitoring and indicate:
 - a. Fluoride Metering Pump(s) Running (call only, no report back)
 6. Alarms:
 - a. None
- G. Aerator Blower Control (loop 24)
1. General: Aerator blower operates anytime there is at least minimum Raw Ground Water Flow. The Aerator Blower's function is to "strip" gases entrained in the water. The blower continues to run for about 30 seconds after the flow drops below the minimum flow setpoint to allow time for the remaining water in the aerator to drain.
 2. System Interface:
 - a. Automatic control of Aerator.
 - b. Setpoints inputs via the OI unit.
 3. Non-PLC Based Controls:
 - a. Manual control via the "HAND-OFF-AUTO" Selector Switch (MCC).
 - b. Local Lock Out Stop Switch (Field)
 4. PLC Based Controls:
 - a. Aerator Blower call based on minimum flow (PLC setpoint).
 - b. Aerator Blower call revoked based upon flow (an adjustable amount) below minimum flow after an adjustable time delay (PLC setpoints).
 5. Monitoring:
 - a. Aerator Run Status (OI and MCC).
 - b. Aerator Run Time (OI and MCC).
 - c. Aerator in Auto (OI and MCC).
 6. Alarms:
 - a. Aerator Call to Run Failure.
- H. Chlorine Residual (Loop 40)
1. General: Monitor Chlorine Residual.
 2. System Interface:
 - a. Setpoints inputs via the OI unit.
 3. Non-PLC Controls:
 - a. Tap point valves.
 - b. Setpoints via OI Unit.
 4. PLC Based Controls
 - a. Chlorine Metering Pumps pacing signals based upon a conditioned output Compound control loop with raw water flow being the feed-forward portion and residual being the feedback portion when the plant is in "AUTO" mode and PID feedback control (residual only) when the plant is in "BYPASS" mode (see loop descriptions 11 & 13).
 5. Monitoring and indicate:
 - a. Chlorine Residual.
 6. Alarms:
 - a. Chlorine Residual Low.
 - b. Chlorine Residual High.

- I. Fluoride Residual (Loop 41)
 - 1. General: Monitor Fluoride Residual.
 - 2. System Interface:
 - a. Setpoints inputs via the OI unit.
 - 3. Non-PLC Controls:
 - a. Tap point valves.
 - b. Setpoints via OI Unit.
 - 4. PLC Based Controls
 - a. Fluoride Metering Pumps pacing signals based upon a conditioned output Compound control loop with treated water flow being the feed-forward portion and residual being the feedback portion when the plant is in "AUTO" mode and PID feedback control (residual only) when the plant is in "BYPASS" mode (see loop descriptions 14 & 60). Disable injection during Backwash operations.
 - 5. Monitoring and indicate:
 - a. Fluoride Residual.
 - 6. Alarms:
 - a. Fluoride Residual Low.
 - b. Fluoride Residual High.
- J. pH Monitor (Loop 42)
 - 1. General: Monitor pH.
 - 2. System Interface: Setpoints inputs via the OI unit.
 - 3. Non-PLC Controls:
 - a. Tap point valves.
 - b. Setpoints via OI Unit.
 - 4. PLC Based Controls: None.
 - 5. Monitoring and indicate: pH Level.
 - 6. Alarms:
 - a. Low Alarm.
 - b. High Alarm.
- K. Power, Generator, ATS, Diesel Tank Monitor (Loops 43-45)
 - 1. General: Monitor power failure, generator run, generator fail, ATS in standby position and diesel tank leak.
 - 2. System Interface:
 - 3. Non-PLC Controls: Local control.
 - 4. PLC Based Controls: None.
 - 5. Monitoring and indicate: System status.
 - 6. Alarms: None.
- L. Backwash Tank Decant Flow and Tank Level (Loops 61 and 71)
 - 1. General: The backwash tank receives backwash water from the filters, decants via a motor actuated butterfly valve and discharges it by gravity to a drain via a motor actuated butterfly valve. A high tank level, Low System Pressure or Lead Booster Pump Failure will prevent or abort backwash operations. The Backwash Tank Decant Flowmeter monitors decant flow.
 - 2. System Interface:
 - a. Backwash Tank Decant Flow Control Valve.
 - b. Backwash Tank Waste Valve.
 - c. Booster Pumps.
 - d. Filter Control Panel.

- e. Setpoints via OI Unit.
- 3. Controls:
 - a. Backwash Inhibit at adjustable high BW tank level setpoint.
 - b. Backwash abort (hold) at adjustable high tank level.
 - c. Backwash Tank Decant Valve call based on either time after completion of backwash, or time and level. Percent open based upon controlling flow to 1/10th (adjustable setpoint in a simple feedback loop) of raw water flow.
 - d. Backwash Tank to Waste based on completion of backwash decant after X number of backwash operations, X number of days after last BW to Waste, on high/high level, or manually.
- 4. Monitor and Indicate:
 - a. Flow (at transmitter and OI).
 - b. Totalized Flow (OI).
 - c. Tank Level (OI).
 - d. Valve Position (OI).
- 5. Alarms:
 - a. Tank high/high level alarm.
 - b. BW flow rate high alarm.
 - c. BW flow rate low alarm.
 - d. Valve Failure

M. Filtered Water Flow, Backwash Flow and Backwash Flow Control (Loops 60 & 70)

- 1. General: The bi-directional flow meter provides analog flow signal to the PLC for starting and stopping the Fluoride Metering Pumps, and pacing the Fluoride Metering Pumps in the forward direction. The flow meter provides a control of the Backwash Flow Control Valve in the reverse direction.
- 2. System Interface:
 - a. Automatic control of Fluoride Metering Pumps.
 - b. Pacing of Fluoride Metering Pumps.
 - c. Backwash Flow Control Valve.
 - d. Setpoints inputs via the OI unit.
- 3. Non-PLC Controls:
 - a. None.
- 4. PLC Based Controls
 - a. Fluoride Metering Pumps call based on minimum flow (PLC setpoint).
 - b. Fluoride Metering Pumps call revoked based upon flow (an adjustable amount) below minimum flow (PLC setpoint).
 - c. Fluoride Metering Pumps pacing signals based upon a conditioned output (Compound control loop and PID control loop - see loop descriptions 14 & 41).
 - d. Control the Backwash Flow Control Valve to maintain the Backwash Flow Setpoint.
 - e. Disable fluoride injection when reverse flow (backwash operations).
- 5. Monitoring and indicate:
 - a. Filtered Water Flow and totalized flow.
 - b. Backwash Flow and totalized flow.
 - c. Valve Position (OI).
- 6. Alarms:
 - a. High flow alarm (PLC setpoint).

b. Valve Failure.

N. System Pressure Sensor (Loop 80)

1. General: Monitor system pressure and alarm on low pressure and inhibit backwash events.
2. System Interface: Setpoints via OI Unit.
3. Controls: Disable backwash on low pressure.
4. Monitor and Indicate: System Pressure.
5. Alarms:
 - a. Low System Pressure.
 - b. High System Pressure.

O. Filter Control (Loops 31, 41 and 51)

1. General: The Filter Control Panel and PLC are required to operate the filter valves and booster pumps for normal filter operation and surface washing.
2. System Interface:
 - a. Booster Pumps.
 - b. Filter Control Panel.
 - c. Backwash Tank Valves.
3. Controls: The operations and controls described below are for one filter. PLC programming is to be replicated as required to also operate the other two filters as a complete three-filter system.
 - a. Provide control for each valve specified in Table 1, as shown on the P&IDs, and/or described below.

TABLE NO. 1 - VALVE OPERATION CHART

<u>SYSTEM</u>	<u>VALVE NO.</u>				
System	29	30	70		
Filter No. 1				31A	31B
				32	33
				34	
Filter No. 2				41A	41B
				42	43
				44	
Filter No. 3				51A	51B
				52	53
				54	

OPERATION SEQUENCE

			M*					
Surface Wash & Backwash	X	O*	O	X	O	O	X	O
			M*					
Backwash	X	X	O	X	O	X	X	O
Rinse (Individual Filter)	O	X	X	O	X	X	O	X
Filtering	O	X	X	O	X	X	X	O

M* Modulating

X* Partially Closed/Open

TABLE NO. 1 - VALVE OPERATION CHART

X Closed
O Open

b. Backwash Selector Switch allows initiation of filter backwashing either automatically or manually. When in AUTO position all filters will be backwashed on:

- 1) any high differential pressure; or
 - 2) at a set time on set days of the week; or
 - 3) based upon elapsed filter run time since completion of last backwash sequence.
- except,
- 4) backwash abort (hold) at adjustable high backwash holding tank level.

When in MANUAL, the filter selected for backwash (via the Filter Selection Input of the OI) will be called to backwash. All parameters and setpoints shall be selected at the OI Unit.

Note that the Backwash Selector Switch input of the OI, will be two position (AUTO/MANUAL) with a separate BACKWASH START selector and FILTER selector.

c. Filter Selection Switch input of the OI allows selecting filter for manual backwash. This switch is a four position selector (FILTER 1/FILTER 2/FILTER 3/ALL FILTERS). The normal position for this input is "ALL FILTERS".

d. High Differential Pressure, measure across the filters, automatically initiates a backwash when the headloss across the filters reaches its adjustable setpoint and the Backwash Selector input is in the AUTO position.

e. Filter Run Time Indicator/controller automatically initiates a backwash for all filters when the run time exceeds an adjustable preset value. The timer is only activated when the booster pump(s) is running. Timer is automatically reset after a backwash.

f. PLC/OI clock/calendar initiates a backwash for all filters on a particular day of the week at a specific time (unless function disabled).

g. Backwash Handling Tank Level stops backwash in progress or prevents backwash if level is high (adjustable setpoint).

h. Backwashing Sequence is generally as follows:

Step 1: Shut down booster pumps, and well pumps. Close filter system inlet valve (V29).

Step 2: Close Filter Nos. 2 and 3 filter inlet and outlet valves (V41A, V44, V51A & V54).

Step 3: Close Filter No. 1 inlet valve (V31A) and open Filter No. 1 backwash valve (V31B).

Step 4: Open Filter No. 1 surface wash valve (V32).

Step 5: Call Booster Pump No. 1 (Lead) to start and ramp up to the Booster Pump Backwash Minimum Speed Setpoint (adjustable, initially set at 50%). Open the surface wash valve and control VFD speed to maintain the Surface Wash Flow Setpoint (initially set at 384 GPM).

Step 6: Open the backwash feed water valve (V70) and modulate to

maintain the Backwash Feed Water Flow Setpoint (initially set at 3072 GPM).

Filter No. 1 is now in combined backwash and surface wash.

Step 7: Combined surface wash and backwash proceeds for the Combined Surface Wash/Backwash Time Setpoint (initially set at 5 minutes, but adjustable from 1 to 30 minutes).

Step 8: Close Filter No. 1 surface wash valve (V32) and backwash alone proceeds for the Backwash Time Setpoint (initially set at 8 minutes, but adjustable from 1 to 30 minutes).

Step 9: Slowly close the backwash feed water valve (V70), close Filter No. 1 backwash valve (V31B) and outlet valve (V34) and open Filter No. 1 inlet valve (V31A).

Step 10: Repeat steps 3 through 9 for each online filter (unless a single filter was selected for manual backwash).

Step 11: At the end of the backwash for the last filter close filter system surface wash valve (V30).

Step 12: Start the filter rinse sequence. Open the system filter rinse valve (V29). Open Filter No. 1 rinse valve (V33). Start Booster Pump No. 1 and slowly increase the flowrate to the Rinse Flow Setpoint (initially set at 1167 GPM). Rinse Filter No. 1 for the Rinse Time Setpoint amount of time (initially set at 2 minutes, but adjustable from 1 to 10 minutes). Rinse water is discharged back to the Aerated Sump. Close Filter No. 1 rinse valve (V33) while simultaneously opening Filter No. 2 rinse valve (V43). Repeat the rinse sequence for all online filters.

Step 13: After the entire filter rinse sequence is completed open all online filter outlet valves (initially V34, V44 & V54).

All online filters are in the filter mode and normal filtering operations shall begin.

4. Monitor and indicate:
 - a. Filter differential pressure High (OI).
 - b. Filter run time (OI).
 - c. Backwash Tank level High indication (OI).
 - d. Backwash in progress for each filter (OI).
 - e. Backwash required for each filter (OI).
 - f. Backwash flow rate (OI).
 - g. Surface wash flow rate (OI).
5. Alarms:
 - a. Backwash required
6. Comments:
 - a. Automatic valves shall fail to their normal (filtering) position.
 - b. Backwash required alarm is based on one of the two following events:
 - 1) If filter differential pressure or filter run time exceed their setpoints but the backwash selector switch is not in AUTO position; or
 - 2) If backwash is inhibited by high backwash tank level,

booster pumps not in AUTO, etc.

P. Miscellaneous

1. Monitor power failure relay and shut down all pumps, other equipment and filters. Provide for an orderly restart on power return.
2. Monitor UPS power failure.
3. Control the automatic bubbler purge cycle.
4. Monitor intrusion system.
5. Communicate with Siemens local FID/DTC (RTU).

2.4 OPERATOR INTERFACE UNIT

A. Provide programming for the operator interface unit (OI). Provide up to fifteen different screens to monitor and control the water treatment plant by interfacing with the PLC.

B. Screens

1. Overview Screen - show the status of the Well Pumps (as a group), Flows, Filters, Valves, Sump, Booster Pumps, Chlorine Metering Pumps, Chlorine Residual, Fluoride Metering Pumps, Fluoride Residual, Aerator Blower, and alarms in graphic animation. Indicate new alarms, run time, levels, pressure and flows by alphanumeric characters. Show process lines graphically. Provide method to move to other screens.
2. Display Screen - Show sump level, Backwash Tank Level status, Backwash Flow, Filter D/P status, Raw Ground Water and System Flows and totalized flows, Booster Pumps status and speeds and Aerator status graphically and alphanumerically.
3. Filter Screens - Show the status of three filters (with provisions for three more filters hidden or on other screens) graphically animated, Backwash flow, Backwash Tank status, Surface Wash Flow, System Flow alphanumerically. Provide a method to move between the individual filter screens.
4. Individual Filter Screens - Provide all controls and monitoring functions associated with each of the filters. Enter time based setpoints for valves.
5. Well Pump Screen - Monitoring the Well Pumps as a group. Indicate status and Raw Ground Water Flow.
6. Booster Pumps Screen - Provide all the controls and monitoring including provisions for entering setpoints and alternation mode for all new and future Booster Pumps. Indicate status and Filter Flow.
7. Alarm Screen - List all recent alarms. Provide provisions for acknowledgement, reset and silence of new alarms.
8. Setpoints Screen - Provide a screen for input of all setpoints. Include a numeric keypad and all functional requirements. Provide password protection with this screen.

C. All PLC information shall be available via the O/I.

2.5 CENTRAL COMPUTER AND LOCAL RTU PROGRAMMING

All programming and configuring of the existing central EMCS computer and local FID/DTC (RTU) will be provided under section 13820.

The Contractor shall be responsible for coordinating/providing a detailed

PLC I/O listing to the EMCS/FID/DTC vendor as soon as the Submittal is approved to allow the EMCS/FID/DTC vendor to configure the existing Central Computer and program the local FID/DTC (RTU).

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13416

CHEMICAL STORAGE TANK

03/01

PART 1 GENERAL

- 1.1 DESCRIPTION
- 1.2 QUALITY ASSURANCE
- 1.3 SUBMITTALS
- 1.4 SEISMIC PROTECTION

PART 2 PRODUCTS

- 2.1 PLASTIC CHEMICALS TANKS

PART 3 EXECUTION

- 3.1 SHIPPING
- 3.2 INSTALLATION
- 3.3 TESTING

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 13416

CHEMICAL STORAGE TANK

03/01

PART 1 GENERAL

1.1 DESCRIPTION

Work included: Provide one (1) Hydrofluosilicic acid (Fluoride) chemical tank, complete with seismically designed anchorage and accessories as shown on the Drawings and/or specified herein.

1.2 QUALITY ASSURANCE

A. The product furnished under this Section shall:

1. Be of a single manufacturer who has been regularly engaged in the designed and manufacture of plastic tanks for at least five years.
2. Be demonstrated to the satisfaction that the quality is equal to equipment made by those manufacturers specifically named herein.

B. Tank manufacturer must be capable of providing the names and specific locations of customers for whom he has furnished and installed tanks that have been in service 5 years or more.

C. Code Section with special application: Comply with the Uniform Fire Code, particularly Article 80, and the Uniform Building Code, particularly Chapter 9.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Chemical Resistance Data; FIO.

Provide data for proposed material relating to the listed service condition.

SD-04 Drawings

Shop Drawings; GA.

Submit shop drawings for favorable review of the tank system. The submittals shall contain sufficient data to show that the tank conforms to the Specification requirements, including: location and type of pipe

connections, drains, and other appurtenances, details of tank construction, wall thickness, and material specifications of tank, and fittings for the tank. Sufficient data is to be provided for the tank anchorage that will clearly demonstrate compliance with these Specifications.

SD-13 Certificates

Affidavits; FIO.

Furnish affidavits from the manufacturer stating that the tank has been properly installed and tested and is ready for full time operation.

SD-19 Operation and Maintenance Manuals

Manuals; FIO.

Furnish manufacturer's installation and operation and maintenance manuals.

1.4 SEISMIC PROTECTION

A. Tanks specified herein require seismic restraint.

PART 2 PRODUCTS

2.1 PLASTIC CHEMICALS TANKS

A. Service Conditions: Provide tank suitable for indoor chemical storage designed for 110°F maximum operating temperature, seismic conditions, superimposed mechanical load, and the following conditions:

Hydrofluosilicic acid, 23 percent strength.

B. Tank shall be 500 gallons. Maximum tank diameter is 4 feet and maximum tank height is 7 feet.

C. Tank shall be manufactured of high density crosslinked rotationally molded polyethylene and shall be suitable for the chemical concentrations listed. A 24-inch diameter manway and cover in the tank top shall be made of crosslinked polyethylene with one-half inch buttress threads (no metal). Other openings and fittings shall be provided as shown on the Drawings.

Tank shall be manufactured by Poly Cal Plastics, or equivalent.

D. Resin used in the tank manufacture shall be crosslinkable polyethylene MARLEX CL200 as manufactured by Phillips Chemical, or equivalent. The rotationally molded tanks shall meet or exceed the following properties:

PARAMETER	ASTM TEST	QUANTITY
Density, gms/cc	D1505	0.938-0.941
Environmental stress cracking resistance, F50, hours	D1693	>1000

PARAMETER	ASTM TEST	QUANTITY
Tensile strength, ultimate psi, type IV specimen	D638	2600
Elongation at break, %, type IV specimen	D638	450
Vicat softening point	D1525	~255°F
Brittleness temperature	D746	<-180°F

E. Impact test results must meet the requirements of 120 foot pounds at minus forty degrees Fahrenheit (-40°F). Test procedures to be equal to Phillips Chemical procedure described in bulletin TSM-291.

F. Wall thickness for a given hoop stress to be calculated by the Barlow formula. Provide wall thickness required by the Barlow formula. Design tank with a minimum hoop stress no greater than 600 psi and a safety factor of no less than 2 using the Barlow formula. Wall thickness calculations shall assume that all tanks contents have a specific gravity of not less than 1.5. Design tanks for higher specific gravities where noted in the tank schedule or the special requirements.

G. Manufacturer shall have the capability of issuing gel test results with 1/8" inner wall reading no less than 65% gel and outer wall no less than 90% gel. Entire thickness must be more than 80% gelled. Procedure to run is described in Phillips Technical bulletin TSM-291.

H. Tank colors shall be natural unless specified otherwise.

I. Fittings:

1. PVC Fittings shall be compression type, long shank, deep cut thread (not injection molded) with dual wide nut. Fittings will be made vertical on sloping tank tops as indicated.
2. Chemical duty bolt shall use Hasteloy bolts with internal polypropylene injection molded encapsulated heads and CPVC external flanges.
3. Integrally Molded Flanged Outlets shall be molded as an original part of the tank.
4. Hasteloy fittings shall be compression type with external bolts and nuts.
5. Gaskets shall be crosslinked polyethylene closed cell foam material.
6. Flanges shall comply with ANSI B16.1.

J. Connections to Tank: Connection fittings shall be flanged and constructed from PVC unless noted otherwise. Reducers shall be used to adapt tank connection sizes to piping sizes shown on the Drawings. Install the following connection sizes:

1. One one-inch flanged outlets for connection to the metering pumps.
2. One-inch flanged connection at top of tank for fill line. Provide short fill line with quick connect coupling located for convenient filling of tank.
3. One one-inch flanged connection at top of tank for vent.

4. One one-inch flange connection for drain.

K. Seismic tank restraint: The restraint shall be built and installed in conformance with plans and instructions certified by a registered civil engineer. The lateral restraint system shall be designed for seismic zone 3, and shall conform to the Uniform Building Code.

L. Accessories: Provide reverse float level indicator.

PART 3 EXECUTION

3.1 SHIPPING

A. Ship tanks on padded saddles and tied down with padded slings.

3.2 INSTALLATION

A. Install tanks in strict conformance with the manufacturer's installation instructions and as shown on the Drawings. Coordinate concrete pad requirements with the tank manufacturer.

3.3 TESTING

A. Shop Testing

1. Shop test the chemical storage tank. No leakage is allowed over a 5-hour minimum test period. Subject tanks to a 4-psi pressurized leak test to locate pinholes or other defects. Submit certified test results.

2. Do not ship tanks until they have received favorable review.

B. Field Testing

1. Test all tanks after they are plumbed in by completely filling the tank with water. No leakage is allowed over a 48-hour minimum test period. If a leak is detected, the tank shall be replaced or repaired in a manner satisfactory to the Contracting Officer. Repairs shall only be performed by the tank manufacturer, at no additional cost to the Government. After repairs, retest the tank. Demonstrate that all tank accessories work properly.

2. After completing the static leak test, drain the water, hand wipe, and dry as required to leave the tank interior clean and ready for storage of chemicals. Then test each chemical feed system as specified in Section 11355.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13721

SMALL INTRUSION DETECTION SYSTEM

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 General
 - 1.2.2 Overall System Reliability Requirement
 - 1.2.3 Definitions
 - 1.2.3.1 Intrusion Alarm
 - 1.2.3.2 Nuisance Alarm
 - 1.2.3.3 Environmental Alarm
 - 1.2.3.4 False Alarm
 - 1.2.4 Electrical Requirements
 - 1.2.5 Environmental Conditions
 - 1.2.5.1 Interior, Uncontrolled Environment
 - 1.2.5.2 Exterior Environment
- 1.3 SUBMITTALS
- 1.4 TESTING
- 1.5 EXPERIENCE
 - 1.5.1 Hardware Manufacturer
 - 1.5.2 Software Manufacturer
 - 1.5.3 System Installer

PART 2 PRODUCTS

- 2.1 GENERAL REQUIREMENTS
 - 2.1.1 Materials and Equipment
 - 2.1.2 Enclosures
 - 2.1.2.1 Interior Electronics
 - 2.1.2.2 Exterior Electronics
 - 2.1.3 Nameplates
 - 2.1.4 Locks and Key-Lock Switches
 - 2.1.4.1 Locks
 - 2.1.4.2 Construction Locks
 - 2.1.5 Application of System Component
 - 2.1.5.1 Maintainability
 - 2.1.5.2 Interchangeability
 - 2.1.5.3 Electromagnetic and Radio Frequency Interference (EMI/RFI)
 - 2.1.5.4 Product Safety
 - 2.1.6 Controls and Designations
 - 2.1.7 Special Test Equipment
 - 2.1.8 Alarm Output

- 2.1.9 Alarm Indicator Lights
- 2.1.10 Access/Secure Devices
 - 2.1.10.1 Key Pads
- 2.2 INTERIOR SENSORS
 - 2.2.1 Balanced Magnetic Switch (BMS)
 - 2.2.1.1 BMS Subassemblies
- 2.3 FIELD PROCESSING HARDWARE
 - 2.3.1 Alarm Annunciation Local Processor
 - 2.3.2 Processor Power Supply
 - 2.3.3 Auxiliary Equipment Power
- 2.4 FIELD PROCESSING SOFTWARE
 - 2.4.1 Operating System
 - 2.4.1.1 Startup
 - 2.4.1.2 Operating Mode
 - 2.4.1.3 Failure Mode
 - 2.4.2 Functions
- 2.5 WIRE AND CABLE
 - 2.5.1 General
 - 2.5.2 Above Ground Sensor Wiring
 - 2.5.3 Class 2 Low Energy Conductors

PART 3 EXECUTION

- 3.1 GENERAL
 - 3.1.1 Installation
 - 3.1.2 Enclosure Penetrations
 - 3.1.3 Cold Galvanizing
- 3.2 SYSTEM STARTUP
- 3.3 SITE TESTING
 - 3.3.1 General
 - 3.3.2 Contractor's Field Testing
 - 3.3.3 Performance Verification Test

-- End of Section Table of Contents --

SECTION 13721

SMALL INTRUSION DETECTION SYSTEM
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI X3.92	(1981; R 1987) Data Encryption Algorithm
ANSI X3.154	(1988; R 1994) Office Machines and Supplies - Alphanumeric Machines-Keyboards Arrangement

CODE OF FEDERAL REGULATIONS (CFR)

47 CFR 15	Radio Frequency Devices
47 CFR 68	Connection of Terminal Equipment to the Telephone Network

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA ANSI/EIA/TIA-232-E	(1991) Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
------------------------	---

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE C62.41	(1991) Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 100	(1997) IEEE Standard Dictionary of Electrical and Electronics Terms
IEEE Std 142	(1991) IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems

INTERNATIONAL TELECOMMUNICATION UNION (ITU)

- ITU V.34 (1994) Data Communication Over the Telephone Network A Modem Operating at Data Signaling Rates of up to 28,000 bits for use on the General Switched Telephone Network and on Leased Point-to-Point Two-Wire Telephone Type Circuits
- ITU V.42 (1993) Data Communications Over the Telephone Network Error-Correcting Procedures for DCEs Using Asynchronous-to-Synchronous Conversion
- ITU V.42 bis (1990) Data Compression Procedures for Data Circuit Terminating Equipment (DCE Using Error Correction Procedures)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA 250 (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
- NEMA ICS 1 (1993) Industrial Control and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (1999; Errata) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

- UL 294 (1994; Rev thru May 1997) Access Control System Units
- UL 639 (1993; Rev thru Feb 1995) Intrusion-Detection Units
- UL 681 (1994) Installation and Classification of Mercantile and Bank Burglar-Alarm Systems
- UL 796 (1993; Rev thru Jul 1996) Printed-Wiring Boards
- UL 1037 (1994; Rev thru May 1997) Antitheft Alarms and Devices
- UL 1076 (1995; Rev thru May 1996) Proprietary Burglar Alarm Units and Systems

1.2 SYSTEM DESCRIPTION

1.2.1 General

The Contractor shall configure the Intrusion Detection System (IDS) as described and shown, including Government Furnished Equipment (GFE).

Computing devices, as defined in 47 CFR 15, shall be certified to comply with the requirements for Class A computing devices and labeled as set forth in 47 CFR 15.

1.2.2 Overall System Reliability Requirement

The system, including all components and appurtenances, shall be configured and installed to yield a mean time between failure (MTBF), as defined in IEEE Std 100, of at least 10,000 hours continuous operation.

1.2.3 Definitions

1.2.3.1 Intrusion Alarm

An alarm resulting from the detection of a specified target and which results in an attempt to intrude into the protected area or when entry into an entry controlled area is attempted without successfully using entry control procedures.

1.2.3.2 Nuisance Alarm

An alarm resulting from the detection of an alarm stimuli, but which does not represent an attempt to intrude into the protected area.

1.2.3.3 Environmental Alarm

An alarm during environmental conditions which exceed those specified.

1.2.3.4 False Alarm

An alarm when there is no alarm stimulus.

1.2.4 Electrical Requirements

Electrically powered IDS equipment shall operate on 120 volt 60 Hz AC sources as shown. Equipment shall be able to tolerate variations in the voltage source of plus or minus 10 percent, and variations in the line frequency of plus or minus 2 percent with no degradation of performance.

1.2.5 Environmental Conditions

1.2.5.1 Interior, Uncontrolled Environment

All system components installed in interior locations having uncontrolled environments shall be rated for continuous operation under ambient environmental conditions of 0 to 122 degrees F dry bulb and 10 to 95 percent relative humidity, noncondensing.

1.2.5.2 Exterior Environment

System components that are installed in locations exposed to weather shall be rated for continuous operation under ambient environmental conditions of minus 30 to 122 degrees F dry bulb and 10 to 95 percent relative humidity, condensing. In addition, the system components shall be rated for

continuous operation when exposed to performance conditions as specified in UL 294 and UL 639 for outdoor use equipment. In addition, components shall be rated for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph and snow cover up to 2 feet thick, measured vertically.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Spare Parts; FIO.

Data lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of detail drawings.

The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended for stocking.

SD-04 Drawings

Intrusion Detection System; FIO.

- a. System block diagram.
- b. Console installation, block diagrams, and wiring diagrams.
- c. Processor installation, typical block, and wiring diagrams.
- d. Details of connections to power sources, including power supplies and grounding.
- e. Details of surge protection device installation.
- f. Sensor detection patterns.

SD-06 Instructions

Manufacturer's Recommendations; FIO.

Printed copies of manufacturer's recommendations for installation of materials prior to installation. Where installation procedures, or any part thereof, are required to be in accordance with manufacturer's recommendations, installation of the item will not be allowed to proceed until the recommendations are received and approved.

SD-08 Statements

Test Plan; FIO.

Test plan defining all tests required to ensure that the system meets technical, operational and performance specifications, 60 days prior to proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of

each test and procedures for evaluation and documentation of the results.

Experience; FIO

The qualifications of the Manufacturer, Contractor, and Installer to perform the work specified herein.

SD-09 Reports

Test Reports; FIO.

Test reports, in booklet form with witness signatures verifying execution of tests. Reports shall show the field tests to verify compliance with the specified performance criteria. Test reports shall include records of the physical parameters verified during testing. Test reports shall be submitted within 7 days after completion of testing.

Materials and Equipment; FIO.

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

1.4 TESTING

The Contractor shall perform site testing and adjustment of the completed intrusion detection system. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the Government at least 14 days prior to the test, and in no case shall notice be given until after the Contractor has received written approval of the specific test procedures.

1.5 EXPERIENCE

The Contractor shall submit written proof that the following experience requirements are being met.

1.5.1 Hardware Manufacturer

All system components shall be produced by manufacturers who have been regularly engaged in the production of intrusion detection system components of the types to be installed for at least 3 years.

1.5.2 Software Manufacturer

All system and application software shall be produced by manufacturers who have been regularly engaged in the production of intrusion detection system

and application software of similar type and complexity as the specified system for at least 2 years.

1.5.3 System Installer

The system shall be installed by a contractor who has been regularly engaged in the installation of intrusion detection systems of similar type and complexity as the specified system for at least 2 years.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

2.1.1 Materials and Equipment

Units of the same type of equipment shall be products of a single manufacturer. All material and equipment shall be new and currently in production. Each major component of equipment shall have the manufacturer's model and serial number in a conspicuous place.

2.1.2 Enclosures

System enclosures shall be as shown.

2.1.2.1 Interior Electronics

System electronics to be used in an interior environment shall be housed in enclosures which meet the requirements of NEMA 250 Type 12.

2.1.2.2 Exterior Electronics

System electronics to be used in an exterior environment shall be housed in enclosures which meet the requirements of NEMA 250 Type 4X.

2.1.3 Nameplates

Laminated plastic nameplates shall be provided for local processors. Each nameplate shall identify the local processor and its location within the system. Laminated plastic shall be 1/8 inch thick, white with black center core. Nameplates shall be a minimum of 1 by 3 inches, with minimum 1/4 inch high engraved block lettering. Nameplates shall be attached to the inside of the enclosure housing the local processor. Other major components of the system shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a corrosion resistant plate secured to the item of equipment. Nameplates will not be required for devices smaller than 1 by 3 inches.

2.1.4 Locks and Key-Lock Switches

2.1.4.1 Locks

Locks shall be installed on system enclosures for maintenance purposes. Locks shall be UL listed, conventional key type lock having a combination of five cylinder pin and five-point three position side bar. Keys shall be

stamped "U.S. GOVT. DO NOT DUP." The locks shall be so arranged that the key can only be withdrawn when in the locked position. All maintenance locks shall be keyed alike and only two keys shall be furnished for all of these locks. These keys shall be controlled in accordance with the key control plan.

2.1.4.2 Construction Locks

If the Contractor requires locks during installation and construction, a set of temporary locks shall be used. The final set of locks installed and delivered to the Government shall not include any of the temporary locks.

2.1.5 Application of System Component

System components shall be designed for continuous operation. Electronic components shall be solid state type, mounted on printed circuit boards conforming to UL 796. Printed circuit board connectors shall be plug-in, quick-disconnect type. Power dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current carrying capacity. Light duty relays and similar switching devices shall be solid state type or sealed electro-mechanical.

2.1.5.1 Maintainability

Components shall be designed to be maintained using commercially available tools and equipment. Components shall be arranged and assembled so they are accessible to maintenance personnel. There shall be no degradation in tamper protection, structural integrity, EMI/RFI attenuation, or line supervision after maintenance when it is performed in accordance with manufacturer's instructions. The system shall be configured and installed to yield a mean time to repair (MTTR) of not more than 8 hours. Repair time is the clock time from the time maintenance personnel are given entrance to the system and begin work, until the system is fully functional.

2.1.5.2 Interchangeability

The system shall be constructed with off-the-shelf components which are physically, electrically and functionally interchangeable with equivalent components as complete items. Replacement of equivalent components shall not require modification of either the new component or of other components with which the replacement items are used. Custom designed or one-of-a-kind items shall not be used. Interchangeable components or modules shall not require trial and error matching in order to meet integrated system requirements, system accuracy, or restore complete system functionality.

2.1.5.3 Electromagnetic and Radio Frequency Interference (EMI/RFI)

System components generating EMI/RFI shall be designed and constructed in accordance with 47 CFR 15.

2.1.5.4 Product Safety

System components shall conform to applicable rules and requirements of NFPA 70. System components shall be equipped with instruction plates, including warnings and cautions, describing physical safety, and special or important procedures to be followed in operating and servicing system equipment.

2.1.6 Controls and Designations

Controls and designations shall be as specified in NEMA ICS 1.

2.1.7 Special Test Equipment

The Contractor shall provide all special test equipment, special hardware, software, tools, and programming or initialization equipment needed to start or maintain any part of the system and its components. Special test equipment is defined as any test equipment not normally used in an electronics maintenance facility.

2.1.8 Alarm Output

The alarm output of each sensor shall be a single pole double throw (SPDT) contact rated for a minimum of 0.25 A at 24 volts DC.

2.1.9 Alarm Indicator Lights

Indicator lights used throughout the system shall be light emitting diodes (LED) or long life incandescent lamps. The indicator lights used shall be visible from a distance of 30 feet in an area illuminated to 75 foot candles. The indicator lights shall conform to the following color coding:

- a. FLASHING RED to alert an operator that a zone has gone into an unacknowledged alarm or that primary power has failed.
- b. RED to alert an operator that a zone is in alarm and that the alarm has been acknowledged.
- c. YELLOW to advise an operator that a zone is in access.
- d. GREEN to indicate that a zone is secure or that power is on.

2.1.10 Access/Secure Devices

2.1.10.1 Key Pads

Secure/Access keypads shall use a unique combination of alphanumeric and other symbols as an identifier. Keypads shall contain an integral alphanumeric/special symbols keyboard with symbols arranged in ascending ASCII code ordinal sequence. The keypad shall have a contact output.

2.2 INTERIOR SENSORS

2.2.1 Balanced Magnetic Switch (BMS)

The BMS shall detect 1/4 inch of separating relative movement between the

magnet and the switch housing. Upon detecting such movement, it shall transmit an alarm signal to the alarm annunciation system.

2.2.1.1 BMS Subassemblies

The BMS shall consist of a switch assembly and an actuating magnetic assembly. The switch mechanism shall be of the balanced magnetic type. Each switch shall be provided with an overcurrent protective device, rated to limit current to 80 percent of the switch capacity. Switches shall be rated for a minimum lifetime of one million operations. The housings of surface mounted switches and magnets shall be made of nonferrous metal and shall be weatherproof. The housings of recess mounted switches and magnets shall be made of nonferrous metal or plastic. Cables shall be armor type.

2.3 FIELD PROCESSING HARDWARE

2.3.1 Alarm Annunciation Local Processor

The alarm annunciation local processor shall respond to interrogations from the field device network, recognize and store alarm status inputs until they are transmitted to the central station and change outputs based on commands received from the central station. The local processor shall also automatically restore communication within 10 seconds after an interruption with the field device network and provide dc line supervision on each of its alarm inputs.

- a. Inputs. Local processor inputs shall monitor dry contacts for change of state that reflect alarm conditions. The local processor shall have at least 8 alarm inputs which allow wiring as normally open or normally closed contacts for alarm conditions; and shall also provide line supervision for each input by monitoring each input for abnormal open, grounded, or shorted conditions using dc current change measurements. The local processor shall report for any condition that remains off normal at an input for longer than 500 milliseconds. Each alarm condition shall be transmitted to the central computer during the next interrogation cycle.
- b. Outputs. Local processor outputs shall reflect the state of commands issued by the central station. The outputs shall be a form C contact and shall include normally open and normally closed contacts. The local processor shall have at least 4 command outputs.

2.3.2 Processor Power Supply

Local processor and sensors shall be powered from an uninterruptible power source. The uninterruptible power source shall provide 6 hours of battery back-up power in the event of primary power failure and shall automatically fully recharge the batteries within 12 hours after primary power is restored. There will be no equipment malfunctions or perturbations or loss of data during the switch from primary to battery power and vice versa. Batteries shall be sealed, non-outgassing type. The power supply shall be equipped with an indicator for ac input power and an indicator for dc

output power. Loss of primary power shall be reported to the central station as an alarm.

2.3.3 Auxiliary Equipment Power

A GFI service outlet shall be furnished inside the local processor's enclosure.

2.4 FIELD PROCESSING SOFTWARE

All field processing software described in this specification shall be furnished as part of the complete system.

2.4.1 Operating System

Each local processor shall contain an operating system that controls and schedules that local processor's activities in real time. The local processor shall maintain a point database in its memory that includes all parameters, constraints, and the latest value or status of all points connected to that local processor. The execution of local processor application programs shall utilize the data in memory resident files. The operating system shall include a real time clock function that maintains the seconds, minutes, hours, date and month, including day of the week. Each local processor real time clock shall be automatically synchronized with the central station clock at least once per day to plus or minus 10 seconds. The time synchronization shall be accomplished without operator intervention and without requiring system shutdown.

2.4.1.1 Startup

The local processor shall have startup software that causes automatic commencement of operation without human intervention, including startup of all connected functions. A local processor restart program based on detection of power failure at the local processor shall be included in the local processor software. The startup software shall initiate operation of self-test diagnostic routines. Upon failure of the local processor, if the database and application software are no longer resident, the local processor shall not restart and systems shall remain in the failure mode indicated until the necessary repairs are made. If the database and application programs are resident, the local processor shall immediately resume operation.

2.4.1.2 Operating Mode

Each local processor shall control and monitor inputs and outputs as specified, independent of communications with the central station. Alarms, status changes and other data shall be transmitted to the central station when communications circuits are operable. If communications are not available, each local processor shall function in a stand-alone mode and operational data, including the status and alarm data normally transmitted to the central station shall be stored for later transmission to the central station. Storage for the latest 1024 events shall be provided at each local processor. Each local processor shall accept software downloaded from the central station.

2.4.1.3 Failure Mode

Upon failure for any reason, each local processor shall perform an orderly shutdown and force all local processor outputs to a predetermined (failure mode) state, consistent with the failure modes shown and the associated control device.

2.4.2 Functions

The Contractor shall provide all software necessary to accomplish the following functions, as appropriate, fully implemented and operational, within each local processor.

- a. Monitoring of inputs.
- b. Control of outputs.
- c. Reporting of alarms automatically to central station.
- d. Reporting of sensor and output status to central station upon request.
- e. Maintenance of real time, updated by the central station at least once a day.
- f. Communication with the central station.
- g. Execution of local processor resident programs.
- h. Diagnostics.
- i. Download and upload data to and from the central station.

2.5 WIRE AND CABLE

2.5.1 General

The Contractor shall provide all wire and cable not indicated as Government furnished equipment. All wiring shall meet NFPA 70 standards.

2.5.2 Above Ground Sensor Wiring

Sensor wiring shall be 20 AWG minimum, twisted and shielded, 2, 3, 4, or 6 pairs to match hardware. Multiconductor wire shall have an outer jacket of PVC.

2.5.3 Class 2 Low Energy Conductors

The conductor sizes specified for digital functions shall take precedence over any requirements for Class 2 low energy signal-circuit conductors specified elsewhere.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall install all system components, including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, IEEE C2 and as shown, and shall furnish necessary interconnections, services, and adjustments required for a complete and operable system as specified and shown.

3.1.1 Installation

The Contractor shall install the system in accordance with the standards for safety, NFPA 70, UL 681, UL 1037 and UL 1076, and the appropriate installation manual for each equipment type. Components within the system shall be configured with appropriate service points to pinpoint system trouble in less than 20 minutes. Minimum size of conduit shall be 1/2 inch. DTS shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other building wiring. Flexible cords or cord connections shall not be used to supply power to any components of the system, except where specifically noted herein. All other electrical work shall be as specified in Division 16000 and as shown. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

3.1.2 Enclosure Penetrations

All enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer, and in such a manner that the cable is not damaged.

3.1.3 Cold Galvanizing

All field welds and/or brazing on factory galvanized components, such as boxes, enclosures, and conduits, shall be coated with a cold-galvanized paint containing at least 95 percent zinc by weight.

3.2 SYSTEM STARTUP

The Contractor shall not apply power to the intrusion detection system until the following items have been completed:

- a. Intrusion detection system equipment items and DTS have been set up in accordance with manufacturer's instructions.
- b. A visual inspection of the intrusion detection system has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
- c. System wiring has been tested and verified as correctly connected

as indicated.

- d. All system grounding and transient protection systems have been verified as properly installed and connected as indicated.
- e. Power supplies to be connected to the intrusion detection system have been verified as the correct voltage, phasing, and frequency as indicated.
- f. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work/equipment.

3.3 SITE TESTING

3.3.1 General

The Contractor shall provide personnel, equipment, instrumentation, and supplies necessary to perform the site testing. The Government will witness all testing. Written permission shall be obtained from the Government before proceeding with the next phase of testing. Original copies of all data produced during performance verification and endurance testing shall be turned over to the Government at the conclusion of each phase of testing prior to Government approval of the test.

3.3.2 Contractor's Field Testing

The Contractor shall calibrate and test all equipment, verify data transmission system (DTS) operation, place the integrated system in service, and test the integrated system. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Government that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.

3.3.3 Performance Verification Test

The Contractor shall demonstrate that the completed system complies with the specified requirements. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown.

The performance verification test, as specified, shall not be started until receipt by the Contractor of written permission from the Government, based on the Contractor's written request. This shall include certification of successful completion of testing as specified in paragraph Contractor's Field Testing, and upon successful completion of training as specified. Upon successful completion of the performance verification test, the Contractor shall deliver test reports and other documentation to the Government, as specified. The Contractor will not be held responsible for failures in system performance resulting from the following:

- (1) An outage of the main power in excess of the capability of any

backup power source, provided that the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the system performed as specified.

- (2) Failure of a Government furnished communications link, provided that the failure was not due to Contractor furnished equipment, installation, or software.
- (3) Failure of existing Government owned equipment, provided that the failure was not due to Contractor furnished equipment, installation, or software.
- (4) The occurrence of specified nuisance alarms.
- (5) The occurrence of specified environmental alarms.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13820

MULTI-BUILDING EXPANSION OF ENERGY MONITORING AND CONTROL SYSTEMS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM EXPANSION DESCRIPTION
 - 1.2.1 System Accuracy and Display
 - 1.2.1.1 Analog Value Input
 - 1.2.2 Symbols, Definitions, and Abbreviations
 - 1.2.3 Power Line Surge Protection
- 1.3 SUBMITTALS
- 1.4 DELIVERY OF TECHNICAL DATA AND COMPUTER SOFTWARE
 - 1.4.1 Group I Technical Data Package
 - 1.4.1.1 System Expansion Drawings
 - 1.4.1.2 Equipment Data
 - 1.4.2 Operation and Maintenance Manuals
 - 1.4.3 Training Documentation
 - 1.4.4 Data Entry Forms
 - 1.4.5 Group IV Technical Data Package
 - 1.4.5.1 Hardware Manual
 - 1.4.5.2 Operator's Manual
 - 1.4.5.3 Maintenance Manual
- 1.5 TESTING
 - 1.5.1 Test Plans
 - 1.5.2 Test Procedures and Reports
- 1.6 TRAINING
- 1.7 MAINTENANCE AND SERVICE
 - 1.7.1 Description of Work
 - 1.7.2 Personnel
 - 1.7.3 Operation
 - 1.7.4 System Modifications

PART 2 PRODUCTS

- 2.1 MATERIALS AND EQUIPMENT
 - 2.1.1 Enclosures
 - 2.1.2 Nameplates
- 2.2 FIELD EQUIPMENT
 - 2.2.1 Field Interface Devices (FID)
 - 2.2.1.1 Controls
 - 2.2.1.2 Indicators
 - 2.2.1.3 Memory
 - 2.2.1.4 FID Communications

- 2.2.1.5 Battery Backup
- 2.2.1.6 Power Fail Automatic Restart
- 2.2.1.7 Mounting Enclosure
- 2.2.2 MUX
 - 2.2.2.1 Control
 - 2.2.2.2 Failure Mode
 - 2.2.2.3 Mounting Enclosure
- 2.2.3 Data Terminal Cabinet
- 2.2.4 I/O Functions
 - 2.2.4.1 Analog Inputs (AI)
 - 2.2.4.2 Analog Outputs (AO)
 - 2.2.4.3 Digital Inputs (DI)
 - 2.2.4.4 Digital Outputs (DO)
 - 2.2.4.5 Pulse Accumulator
 - 2.2.4.6 Signal Conditioning
- 2.3 APPLICATIONS PROGRAMS
 - 2.3.1 Program Inputs
 - 2.3.2 Scheduled Start-Stop Program
 - 2.3.2.1 Program Inputs
 - 2.3.2.2 Program Outputs
- 2.4 EXPANSION FID SOFTWARE
 - 2.4.1 FID Functions
 - 2.4.1.1 Operating System
 - 2.4.1.2 Monitoring and Control
 - 2.4.1.3 FID Self-Test Diagnostics
 - 2.4.2 FID Startup
 - 2.4.3 FID Operational Modes
 - 2.4.3.1 Communicating Mode
 - 2.4.3.2 Failure Mode
- 2.5 WIRE AND CABLE
 - 2.5.1 Control Wiring
 - 2.5.1.1 Digital Functions
 - 2.5.1.2 Analog Functions

PART 3 EXECUTION

- 3.1 GENERAL
 - 3.1.1 Installation
 - 3.1.2 I/O Summary Tables
- 3.2 INSTALLATION OF INTERFACES
 - 3.2.1 FID to MCR Interface
 - 3.2.1.1 Graphics
- 3.3 SITE TESTING
 - 3.3.1 Contractor's Field Testing

-- End of Section Table of Contents --

SECTION 13820

MULTI-BUILDING EXPANSION OF ENERGY MONITORING AND CONTROL SYSTEMS
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1 (1995) Code for Electricity Metering

ANSI X3.154 (1988; R 1994) Office Machines and
Supplies - Alphanumeric Machines-Keyboards
Arrangement

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

ASHRAE-03 (1993) Handbook, Fundamentals I-P Edition

ASHRAE-04 (1993) Handbook, Fundamentals SI Edition

CODE OF FEDERAL REGULATIONS (CFR)

47 CFR 15 Radio Frequency Devices

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA ANSI/EIA/TIA-232-E (1991) Interface Between Data Terminal
Equipment and Data Circuit-Terminating
Equipment Employing Serial Binary Data
Interchange

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE ANSI/IEEE C57.13 (1993) Instrument Transformers

IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC
Power Circuits

IEEE Std 100 (1996) IEEE Standard Dictionary of
Electrical and Electronics Terms

IEEE Std 142 (1991) IEEE Recommended Practice for

Grounding of Industrial and Commercial
Power Systems

MILITARY STANDARDS (MIL-STD)

MIL-STD 2203 (Rev A) Energy Monitoring and Control
Systems Performance Verification and
Endurance Tests

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment
(1000 Volts Maximum)

NEMA ICS 1 (1993) Industrial Controls and Systems

1.2 SYSTEM EXPANSION DESCRIPTION

The Contractor shall expand the existing Energy Monitoring and Control System (EMCS) (Siemens Apogee Automation System) as a distributed processing network as described and shown. The Contractor shall integrate all expansion hardware and software with the existing system and provide a complete and fully functional system. All computing devices, as defined in 47 CFR 15, shall be certified to comply with the requirements for Class A computing devices and labeled as set forth in 47 CFR 15. The integrated expanded system shall provide operator interaction and dynamic process manipulation, including overall total system supervision, coordination, and control. Where they are referred to in this specification, every connected analog output (AO), analog input (AI), digital output (DO), and digital input (DI) represents a point. The existing EMCS system is based on Siemens Apogee (Siemens can be contacted at 916-553-4444).

1.2.1 System Accuracy and Display

The system expansion shall have an end-to-end accuracy from sensor to operator's console display for the expansion specified and shall display the value specified.

1.2.1.1 Analog Value Input

An analog value input to the system's expansion equipment shall be via an AI with a maximum error of 0.50 percent of range, not including the sensor or transmitter error. This accuracy is required over the specified environmental conditions.

1.2.2 Symbols, Definitions, and Abbreviations

All symbols, definitions, and engineering unit abbreviations utilized in information displays and printouts shall conform to IEEE Std 100,ASHRAE-03 ,and , where applicable.

1.2.3 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected

from power line surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

- a. A 10-microsecond by 1000-microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8-microsecond by 20-microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

Fuses shall not be used for surge protection.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Instrumentation and Control System; FIO

Manufacturer's descriptive and technical literature, performance charts and installation instructions. Product specific catalog cuts shall be in booklet form, indexed to the unique identifiers, and shall consist of data sheets that document compliance with the specification. Where multiple components are shown on a catalog cut, the application specific component shall be marked.

SD-04 Drawings

Installation; FIO

Wiring; FIO

Detail drawings containing complete piping, wiring, schematic, flow diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall include, as appropriate: product specific catalog cuts; a drawing index; a list of symbols; a series of drawings for each control system using abbreviations, symbols, nomenclature and identifiers as shown; valve schedules; compressed instrument air station schematics and ASME air storage tank certificates for each type and make of compressed instrument air station.

1.4 DELIVERY OF TECHNICAL DATA AND COMPUTER SOFTWARE

1.4.1 Group I Technical Data Package

1.4.1.1 System Expansion Drawings

The data package shall include the following:

- a. Total system block diagram with expansion added.

- b. Details of connections to power sources, including grounding.
- c. Details of surge protection device installations.

1.4.1.2 Equipment Data

A complete data package shall be delivered for all materials, including field and system expansion equipment provided.

1.4.2 Operation and Maintenance Manuals

A draft copy of the operation and maintenance manuals, as specified for the Group IV technical data package, shall be delivered to the Government for use during performance verification and endurance testing.

1.4.3 Training Documentation

Lesson plans and training manuals for the training phases shall be delivered for approval; these shall include type of training to be provided, with a list of reference material. Training documents shall encompass the total integrated system.

1.4.4 Data Entry Forms

The Contractor shall deliver the completed data entry forms utilizing all data from the contract documents, contractor's field surveys, and all other pertinent information in the Contractor's possession required for complete installation of the data base additions. The Contractor shall identify, and request from the Government, any additional data needed to provide a complete and operational EMCS. The completed forms shall be delivered to the Government for review and approval at least 90 days prior to the Contractor's scheduled need date.

1.4.5 Group IV Technical Data Package

The Group IV technical data package consists of the required manuals. Final copies of the manuals bound in hardback, loose-leaf binders, shall be delivered to the Government within 30 days after completion of the testing. The draft copy used during site testing shall be updated with any changes required, prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manuals shall include the names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and of the nearest service representatives for each item of equipment and each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies shall include all modifications made during installation, checkout, and acceptance. Manuals delivered shall include:

- a. Hardware Manual: two copies.
- b. Operator's Manual: six copies.
- c. Maintenance Manual: two copies.

1.4.5.1 Hardware Manual

The hardware manual shall describe all equipment furnished, including:

- a. General description and specifications.
- b. Installation and checkout procedures.
- c. Equipment electrical schematics and layout drawings.
- d. System schematics and input/output (I/O) wiring lists.
- e. Alignment and calibration procedures.
- f. Manufacturer's repair parts list indicating sources of supply.
- g. Interface definition.

1.4.5.2 Operator's Manual

The operator's manual shall be fully updated and shall explain any changes in procedures and instructions for operation of the system due to the expansion. A cross reference shall be provided of changes to the original manual.

1.4.5.3 Maintenance Manual

The maintenance manual shall be updated and shall include descriptions of maintenance for all equipment added during the expansion, including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components. A cross reference shall be provided of changes to the original manual.

1.5 TESTING

The Contractor shall perform testing and adjustment of the EMCS expansion. Test equipment used to perform any function shall be furnished by the Contractor. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform the testing. Written notification of any planned testing shall be given to the Government at least 14 days prior to any test; notice shall not be given until after the Contractor has received written Government approval of the specific testing procedures.

1.5.1 Test Plans

The test plans shall define all the tests required to ensure that the expanded system meets technical, operational, and performance specifications. The test plans shall define location, milestones for the tests, identifying simulation programs, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

1.5.2 Test Procedures and Reports

The test procedures shall be developed from the test plans and design documentation. The procedures shall consist of detailed instructions for test setup, execution, and evaluation of test results. The test reports shall be used to document results of the tests. Reports shall be delivered to the Government within seven days after completion of each test.

1.6 TRAINING

The Contractor shall conduct training courses for designated personnel in the maintenance and operation of the complete EMCS. The training shall be oriented to the specific expansion system being installed. Training manuals shall be delivered for each trainee with 2 additional copies delivered for archives at the project site. The manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson. The Contractor shall furnish all audiovisual equipment, training materials, and supplies. Where the Contractor presents portions of the course material by audiovisuals, copies of those audiovisuals shall be delivered to the Government either as a part of the printed training manuals or on the same media as that used during the training sessions. A training day is defined as 4 hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. For guidance in planning the required instruction, the Contractor shall assume that attenders will have a high school education or equivalent, and are familiar with EMCS systems. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

1.7 MAINTENANCE AND SERVICE

1.7.1 Description of Work

Adjustment and repair of the EMCS expansion includes any software application programs or updates, data transmission equipment and DTM, FIDs and MUXs which have been installed as part of the expansion. Responsibility of the Contractor will be limited to equipment and software furnished or modified as a part of the EMCS expansion.

1.7.2 Personnel

Service personnel shall be qualified to accomplish all work promptly and satisfactorily. The Government shall be advised in writing of the name of the designated service representative, and of any changes in personnel.

1.7.3 Operation

Performance of scheduled adjustments and repair shall verify operation of the EMCS as demonstrated by the applicable tests of the performance verification test.

1.7.4 System Modifications

The Contractor shall make recommendations for system modification in writing to the Government. System modifications, including operating parameters and control settings, shall not be made without prior approval of the Government. Modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Units of the same type of equipment shall be products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. All materials and equipment shall be currently in production.

2.1.1 Enclosures

Enclosures shall conform to the requirements of NEMA 250 for the types specified. Finish color shall be the manufacturer's standard, unless otherwise indicated. Damaged surfaces shall be repaired and refinished using original type finish. Enclosures installed indoors shall be Type 12 or as shown.

2.1.2 Nameplates

Laminated plastic nameplates shall be provided for all equipment devices furnished. Each nameplate shall identify the function, such as "mixed air controller" or "cold deck temperature sensor." Laminated plastic shall be 1/8 inch thick, white with black center core. Nameplates shall be a minimum of 1 x 3 inches, with minimum 1/4 inch high engraved block lettering. Nameplates for devices smaller than 1 x 3 inches shall be attached by a nonferrous metal chain. All other nameplates shall be attached to the device.

2.2 FIELD EQUIPMENT

2.2.1 Field Interface Devices (FID)

Each FID shall be defined as including specified FID characteristics and functions, in addition to all MUX characteristics and functions, including I/O functions as specified. The FIDs shall be microcomputer-based with a minimum word size of 8 bits. Each FID shall have a minimum of 10 percent of its I/O functions as spare capacity. The type of spares shall be in the same proportion as the implemented I/O functions on the FID, but there shall not be less than two spare points of each implemented I/O type. The FID I/O functions shall be furnished complete, with no changes or additions necessary to support implementation of spare functions. Output relays associated with digital signals shall be considered part of the I/O function, whether physically mounted in the enclosure or separately mounted. Implementation of spare points by others shall necessitate providing only the additional field sensor or control, field wiring including connection to the system, and point definition assignment by the

operator.

2.2.1.1 Controls

The FID shall include the following controls:

- a. Main power switch.
- b. On-off line switch - enables and disables communications with PLC and existing EMCS.
- c. Self test switch - exercise FID functions.
- d. Reset switch - initializes CPU operation.
- e. FID outputs disable switch - forces DE to failure mode.

2.2.1.2 Indicators

The FID shall include the following indicators:

- a. Power On - one for each power supply voltage.
- b. On Line.
- c. "GO" "NO-GO" for self test of FID and all communications functions.
- d. FID outputs disabled.

2.2.1.3 Memory

Sufficient memory shall be provided to perform all specified and shown FID functions and operations, including spares, but shall be no less than 64k bytes.

2.2.1.4 FID Communications

- a. FID to CCU/CCC Communications interfaces shall be provided for each specified DTM circuit between FIDs and the CCU/CCC.
- b. FID to MUX Communications interfaces shall be provided for each specified DTM circuit between each FID and all MUXs which report to that FID.

2.2.1.5 Battery Backup

A sealed battery backup for the FID RAM and real time clock function sufficient to maintain them for a period of 8 hours shall be provided. Automatic charging of batteries shall be provided, or alternately, lithium batteries sized to provide a minimum of 30 days operation and a shelf life of 2 years may be provided.

2.2.1.6 Power Fail Automatic Restart

The FID shall contain hardware to support a power failure automatic restart as specified.

2.2.1.7 Mounting Enclosure

Locking type mounting enclosures, with common keying and door switch wired to a FID input for intrusion alarm annunciation in the MCR, shall be furnished.

2.2.2 MUX

2.2.2.1 Control

The MUX controls shall include main power switch, on-off switch (enables and disables communication) and a MUX output disable switch which forces DE to failure mode.

2.2.2.2 Failure Mode

Upon failure of the MUX, including data transmission failure, the DE shall be forced to the failure mode shown in I/O summary tables.

2.2.2.3 Mounting Enclosure

Locking type mounting enclosures, with common keying and door switch wired to an input for intrusion alarm annunciation in the MCR, shall be provided.

The MUX keying shall be identical to FID keying.

2.2.3 Data Terminal Cabinet

- a. The data terminal cabinet (DTC) shall serve as an interface between each FID or MUX, and the DE instrumentation and controls. Instrumentation or control devices shall not be located within the DTC.
- b. The DTC shall be an independent metallic enclosure not physically part of the FID or MUX. The DTC shall be sized to accommodate the number of I/O functions required for each FID or MUX, including installed spares, plus 25 percent expansion for each type of I/O function provided.
- c. The DTC shall be divided into analog and digital groups.
- d. The DTC shall be provided with double-sided-screw type terminal strips. One side of the terminal strip shall be used for termination of field wiring from instrumentation and controls. The other side shall be used to connect the DTC to the FID or MUX. Terminal strips shall have individual terminal identification numbers.
- e. The DTC shall be a locking type mounting enclosure, with common keying and door switch wired to a FID input for intrusion alarm annunciation in the MCR. The DTC keying shall be identical to FID and MUX keying.

2.2.4 I/O Functions

2.2.4.1 Analog Inputs (AI)

The AI function shall monitor each analog input, perform analog-to-digital (A-to-D) conversion, and hold the digital value in a buffer for interrogation. The A-to-D conversion shall have a minimum resolution of 10 bits plus sign. Signal conditioning shall be provided for each analog input. All analog inputs shall be individually calibrated for zero and span, in hardware or in software. The AI shall incorporate common mode noise rejection of 50 dB from 0 to 120 Hz for differential inputs, and normal mode noise rejection of 20 dB at 60 Hz from a source impedance of 10,000 ohms. Input ranges shall be within the range of 0 to 20 Vdc or 4 to 20 mA.

2.2.4.2 Analog Outputs (AO)

The AO function shall accept digital data, perform digital-to-analog (D-to-A) conversion, and output a signal within the range of 0 to 20 Vdc or 4 to 20 mA_{dc}. The D-to-A conversion shall have a minimum resolution of 8 bits plus sign. All analog outputs shall be individually calibrated for zero and span. Short circuit protection on voltage outputs and open circuit protection on current outputs shall be provided.

2.2.4.3 Digital Inputs (DI)

The DI function shall accept DE on-off, open-close, or other change of state (two-state data) indications. Isolation and protection against an applied steady-state voltage up to 180 Vac peak shall be provided.

2.2.4.4 Digital Outputs (DO)

The DO function shall provide contact closures for momentary and maintained operation of output devices. Closures shall have a minimum duration of 0.1 second. The DO relays shall have an initial breakdown voltage between contacts and coil of at least 500 V peak. Protection against an applied steady-state voltage up to 180 Vac peak shall be provided. Minimum contact rating shall be 1 ampere at 24 Vac.

2.2.4.5 Pulse Accumulator

The pulse accumulator function shall have the same characteristics as the DI, except a buffer shall also be provided to totalize pulses and allow for interrogation by the FID. The pulse accumulator shall accept rates up to 10 pulses per second.

2.2.4.6 Signal Conditioning

Signal conditioning for sensors shall be provided as specified.

2.3 APPLICATIONS PROGRAMS

The system shall perform all functions specified in the I/O summary tables

by use of the appropriate applications programs. All applications programs shall be coordinated, one with the other, to ensure that no conflicts or contentions remain unresolved. The Contractor shall coordinate the applications programs specified with the existing equipment and controls operation, and other requirements as shown.

I/O SUMMARY TABLE

<u>Description</u>	<u>Type</u>	<u>Location</u>	<u>Source</u>
Main pressure (PSI)	AI	FAC	FROM PLC
Main Flow (GPM)	AI	FAC	FROM PLC
Well Pumps Disable	DI	FAC	FROM PLC
Booster Pumps Disable	DO	FAC	FROM PLC
Pump 1 VFD speed (percent)	AI	FAC	FROM PLC
540 Station PSI	AI	FAC	FROM PLC
PH temperature (degrees C)	AI	FAC	FROM PLC
PH (units)	AI	FAC	FROM PLC
Chlorine (milligrams/liter)	AI	FAC	FROM PLC
Fluoride (milligrams/liter)	AI	FAC	FROM PLC
Sump Level	AI		FROM PLC
BW Tank High Level	DI		FROM PLC

2.3.1 Program Inputs

The Contractor shall select the appropriate program inputs listed for each application program to calculate the required program outputs. Where the specific program inputs are not available (for example no status indication is called for on the I/O summary table), a default value shall be provided to replace the missing input, thus allowing the application program to be tested. All analog inputs to applications programs shall have an operator-adjustable deadband to preclude short cycling or hunting.

2.3.2 Scheduled Start-Stop Program

This program shall start and stop equipment based on both a time-of-day schedule for each day of the week and on a holiday schedule. To eliminate power surges, an operator-adjustable time delay shall be provided between consecutive start commands.

2.3.2.1 Program Inputs

- a. Day of week/holiday.
- b. Time of day.
- c. Summer and winter high-low alarm limits.
- d. Summer and winter start-stop schedules.
- e. Summer or winter operation.
- f. Equipment status.
- g. Equipment constraints.

2.3.2.2 Program Outputs

- a. Start signal.
- b. Stop signal.

2.4 EXPANSION FID SOFTWARE

2.4.1 FID Functions

2.4.1.1 Operating System

The FID shall contain an operating system that controls and schedules FID activities in real time. The FID shall maintain a point data base in its RAM that includes all parameters, constraints, and the latest value or status of all points connected to that FID. The execution of FID application programs shall utilize the data in this RAM resident file. The operating system shall include a real time clock function that maintains the seconds, minutes, hours, date and month, including day of the week. Each FID real time clock shall be synchronized with the CCU at least once per day automatically to plus or minus 1 second. The time synchronization shall be accomplished without operator intervention and without requiring system shutdown. The operating system shall allow local loading of software and data files from the portable tester as specified.

2.4.1.2 Monitoring and Control

Each command shall be executed by the FID only after all constraints checks have been passed. Each command point shall have unique constraints assigned. High and low reasonableness values or one differential rate-of-change value shall be assigned to each analog input. Values outside the reasonableness limits shall be rejected and an alarm message sent to the CCU/CCC. Status changes and analog point values shall be reported to the CCU when requested, such as for reports, alphanumeric displays, graphic displays, and applications programs. Each individual point shall be capable of being selectively disabled by the operator from the CCU. Disabling a point shall prohibit monitoring and control of that point.

2.4.1.3 FID Self-Test Diagnostics

Each FID shall have self-test diagnostic routines implemented in firmware. The tests shall include routines that exercise memory.

2.4.2 FID Startup

The FID shall have startup software that causes automatic commencement of operation without human intervention, including startup of all connected MUXs. The startup software shall establish communications with the CCU and enter the communicating mode of operation; if unable to establish communications, the startup software shall enter the noncommunicating mode of operation, except when a low battery condition exists, in which case, the FID shall either revert to or remain in the specified failure mode as

defined in the I/O Summary Tables.

2.4.3 FID Operational Modes

There shall be three operational modes at the FID, including:

- a. Communicating mode (FIDs communicating with CCU/CCC).
- b. Stand-alone (noncommunicating) mode (FIDs not communicating with CCU/CCC).
- c. Failure mode.

2.4.3.1 Communicating Mode

This software shall perform FID functions and FID resident applications programs as specified using commands and updated parameters, including real time clock (RTC) updates transmitted from the CCU. The FID software shall execute commands after performing constraints checks in the FID. Status and analog values, including alarms and other data shall be transmitted to the CCU as specified. The FID shall accept program updates downloaded from the CCU. Constraints shall reside at the FID.

2.4.3.2 Failure Mode

Upon detection of loss of power, the FID shall perform an orderly shutdown and force all FID/MUX outputs to a predetermined state, consistent with the failure modes defined in the I/O summary tables and the control device interfacing with the DE.

2.5 WIRE AND CABLE

The Contractor shall provide all wire and cable not indicated as Government furnished equipment (GFE).

2.5.1 Control Wiring

2.5.1.1 Digital Functions

Control wiring for digital functions shall be 18 AWG minimum with 600 volt insulation. Multiconductor wire shall have an outer jacket of polyvinyl chloride (PVC).

2.5.1.2 Analog Functions

Control wiring for analog functions shall be 18 AWG minimum with 600 volt insulation, twisted and shielded, two, three, or four-wire to match analog function hardware. Multiconductor wire shall have an outer jacket of PVC.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation

The Contractor shall install all system expansion components and appurtenances in accordance with the manufacturer's instructions and as shown. New hardware and software additions and updates shall be integrated with existing hardware and software. The Contractor shall provide all necessary interconnections, services, and adjustments required for a complete and operable system. Wiring, including low voltage wiring, shall be installed in metallic raceways. All other electrical work shall be as specified in Division 16000 and as shown. Instrumentation and communications grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

3.1.2 I/O Summary Tables

The Contractor shall use the I/O summary tables in conjunction with the drawings to identify the hardware and software required.

3.2 INSTALLATION OF INTERFACES

3.2.1 FID to MCR Interface

3.2.1.1 Graphics

The Contractor shall provide graphics for the EMCS expansion.

3.3 SITE TESTING

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. The Government will witness performance verification and endurance testing, and written permission shall be obtained from the Government before proceeding with the next phase of testing. Original copies of all data produced, including results of each test procedure, during performance verification and endurance testing, shall be turned over to the Government at the conclusion of each phase of testing, prior to Government approval of the test. The performance verification and endurance tests shall not be run during scheduled seasonal off-periods of base heating and cooling systems.

3.3.1 Contractor's Field Testing

The Contractor shall calibrate field equipment and completely test DTM. The Contractor shall certify that all field equipment and the DTM are completely operational before the system expansion is placed on-line. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. The Contractor shall calibrate each instrumentation device connected to the expansion EMCS by making a comparison between the reading at the device and the display at the MCR, using a standard traceable to the National Institute of Standards and Technology, which shall be at least twice as accurate as the device to be calibrated. The Contractor shall check each control point within the expansion EMCS by making a comparison between the control command at the MCR and field-controlled device. The Contractor shall verify operation of systems in the specified failure modes upon EMCS failure or loss of power, and shall verify that all systems return to EMCS control automatically upon resumption of EMCS operation or

return of power. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations, including written certification to the Government that the installed complete system has been calibrated, tested, and is ready for operation.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13850

FIRE DETECTION AND ALARM SYSTEM, DIRECT CURRENT LOOP

03/01

PART 1 GENERAL

- 1.1 REFERENCES
 - 1.1.1 Local Permits
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Standard Products
 - 1.2.2 Nameplates
 - 1.2.3 Keys and Locks
 - 1.2.4 Tags
 - 1.2.5 Verification of Dimensions
 - 1.2.6 Compliance
 - 1.2.7 Qualifications
 - 1.2.7.1 Engineer and Technician
 - 1.2.7.2 Installer
 - 1.2.7.3 Design Services
- 1.3 SYSTEM DESIGN
 - 1.3.1 Operation
 - 1.3.2 Operational Features
 - 1.3.3 Alarm Functions
 - 1.3.4 Primary Power
 - 1.3.5 Battery Backup Power
 - 1.3.6 Interface With Existing Fire Alarm Equipment
 - 1.3.7 Interface With Other Equipment
- 1.4 SUBMITTALS
- 1.5 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 CONTROL PANEL
 - 2.1.1 Circuit Connections
- 2.2 STORAGE BATTERIES
- 2.3 BATTERY CHARGER
- 2.4 MANUAL FIRE ALARM STATIONS
- 2.5 FIRE DETECTING DEVICES
 - 2.5.1 Heat Detectors
 - 2.5.2 Smoke Detectors
 - 2.5.2.1 Duct Detectors
- 2.6 NOTIFICATION APPLIANCES
 - 2.6.1 Alarm Bells
 - 2.6.2 Combination Audible/Visual Notification Appliances
- 2.7 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

- 2.7.1 Conduit
- 2.7.2 Wiring
- 2.8 TRANSMITTERS
 - 2.8.1 Radio Alarm Transmitters
 - 2.8.1.1 Transmitter Power Supply
 - 2.8.1.2 Radio Alarm Transmitter Housing
 - 2.8.1.3 Antenna

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Power Supply for the System
 - 3.1.2 Wiring
 - 3.1.3 Control Panel
 - 3.1.4 Detectors
 - 3.1.5 Notification Appliances
 - 3.1.6 Annunciator Equipment
- 3.2 GROUNDING
- 3.3 TESTING
 - 3.3.1 Preliminary Tests
 - 3.3.2 Acceptance Test
- 3.4 TRAINING

-- End of Section Table of Contents --

SECTION 13850

FIRE DETECTION AND ALARM SYSTEM, DIRECT CURRENT LOOP
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S3.41 (1990; R 1996) Audible Emergency
Evacuation Signal

CODE OF FEDERAL REGULATIONS (CFR)

47 CFR 15 Radio Frequency Devices

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a (1998) Approval Guide Fire Protection

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Surge Voltages in
Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NFPA 72 (1999; Errata Oct 96, Dec 96; TIA 96-1,
96-2, 96-3) National Fire Alarm Code

NFPA 90A (1996) Installation of Air Conditioning
and Ventilating Systems

NFPA 1221 (1994) Installation, Maintenance and Use
of Public Fire Service Communication
Systems

UNDERWRITERS LABORATORIES (UL)

UL 6 (1997) Rigid Metal Conduit

UL 38 (1994; Rev Nov 1994)) Manually Actuated

	Signaling Boxes for Use with Fire-Protective Signaling Systems
UL 228	(1997) Door Closers-Holders, With or Without Integral Smoke Detectors
UL 268	(1996; Rev thru Jun 1998) Smoke Detectors for Fire Protective Signaling Systems
UL 268A	(1998) Smoke Detectors for Duct Applications
UL 464	(1996; Rev May 1997) Audible Signal Appliances
UL 521	(1993; Rev Oct 1994) Heat Detectors for Fire Protective Signaling Systems
UL 632/ANSI C33.41	(1994; Rev Sep 1994) Electrically-Actuated Transmitters
UL 797	(1993; Rev thru Mar 1997) Electrical Metallic Tubing
UL 864	(1996) Control Units for Fire-Protective Signaling Systems
UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit
UL 1971	(1995; Rev thru May 1997) Signaling Devices for the Hearing Impaired

1.1.1 Local Permits

Coordinate permits with Base Fire Department. Contact Pat Taum at 634-8677. Contractor shall comply with California OSHA Requirements, Federal OSHA Requirements and local permit requirements (digging permit).

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

1.2.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.2.3 Keys and Locks

Locks shall be keyed alike. Four keys for the system shall be provided.

1.2.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

1.2.5 Verification of Dimensions

After becoming familiar with details of the work, the Contractor shall verify dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.2.6 Compliance

The fire detection and alarm system and the central reporting system shall be configured in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. The equipment furnished shall be compatible and be UL listed, FM approved, or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

1.2.7 Qualifications

1.2.7.1 Engineer and Technician

a. Registered Professional Engineer with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.

b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET certificate.

c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.2.7.2 Installer

The installing Contractor shall provide the following: Fire Alarm Technicians to perform the installation of the system. A Fire Alarm Technician with a minimum of 4 years of experience shall perform/supervise the installation of the fire alarm system. Fire Alarm technicians with a minimum of 2 years of experience shall be utilized to assist in the installation and terminate fire alarm devices, cabinets and panels. An electrician shall be allowed to install wire or cable and to install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the

drawings.

1.2.7.3 Design Services

Installations requiring designs or modifications of fire detection, fire alarm, or fire suppression systems shall require the services and review of a qualified fire protection engineer. For the purposes of meeting this requirement, a qualified fire protection engineer is defined as an engineer with a minimum of 10 years' experience in fire protection engineering.

1.3 SYSTEM DESIGN

1.3.1 Operation

The fire alarm and detection system shall be a complete, supervised fire alarm system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected to initiating device circuits (IDC), Style D, in accordance with NFPA 72. Alarm notification appliances shall be connected to notification appliance circuits (NAC), Style Z in accordance with NFPA 72. A looped conduit system shall be provided so that if the conduit and all conductors within are severed at any point, all IDC, or NAC will remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Textual, audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc.

1.3.2 Operational Features

The system shall have the following operating features:

- a. Monitor electrical supervision of alarm IDC and NAC. Smoke detectors shall have combined alarm initiating and power circuits.
- b. Monitor electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.
- c. A trouble buzzer and trouble light emitting diode (LED) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator LED. Subsequent trouble and supervisory alarms shall sound the trouble signal until silenced. After the system returns to normal operating conditions, the

trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

- d. A one person test mode. Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.
- e. A transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but providing a trouble signal when disconnected and a restoration signal when reconnected.
- f. Evacuation alarm silencing switch which, when activated, will silence alarm devices, but will not affect the zone indicating LED/LCD nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed zone and the NAC devices will be activated.
- g. Electrical supervision for circuits used for supervisory signal services (i.e., sprinkler systems, valves, etc.). Supervision shall detect any open, short, or ground.
- h. Confirmation or verification modules for smoke detection initiating circuits. The modules shall interrupt the transmission of an alarm signal to the system control panel for a factory preset period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal, if present, will be sent immediately to the control panel. Fire alarm devices, other than smoke detectors, will be prohibited on circuits controlled by confirmation or verification modules.
- i. Provide one person test mode - Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.
- j. The fire alarm control panel shall provide the required monitoring and supervised control outputs needed to accomplish elevator recall.
- k. The fire alarm control panel shall provide the required modules to monitor and control the fire sprinkler system, or other fire protection extinguishing system.
- l. Zones for alarm IDC and NAC shall be arranged as indicated on the contract drawings.
- m. The fire alarm control panel shall be readily capable of future expansion and modification by qualified technicians. Examples of required changes are: adding or deleting devices or zones;

changing system responses to particular input signals; programming certain input signals to activate auxiliary devices.

1.3.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the following functions:

- a. Transmission of a signal over the station radio fire reporting system. The signal shall be common for all zones.
- b. Continuous sounding or operation of alarm notification appliances at the building as required by ANSI S3.41.

1.3.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.3.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.3.6 Interface With Existing Fire Alarm Equipment

The equipment specified herein shall operate as an extension to an existing configuration. The new equipment shall be connected to existing monitoring equipment at the Supervising Station via radio (Monaco BT2-7). Existing monitoring equipment shall be expanded, modified, or supplemented as necessary to extend the existing monitoring functions. New components shall be capable of merging with the existing configuration without degrading the performance of either system. The scope of the acceptance tests of paragraph Testing shall include aspects of operation that involve combined use of both new and existing portions of the final configuration.

1.3.7 Interface With Other Equipment

Interfacing components shall be furnished as required to connect to subsystems or devices which interact with the fire alarm system.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Storage Batteries; FIO.

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

Voltage Drop; FIO.

Voltage drop calculations for notification appliance circuits to indicate that sufficient voltage is available for proper appliance operation.

Spare Parts; FIO.

Spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

Technical Data; GGA.

SD-08 Statements

Testing; GA.

Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, for the fire detection and alarm system 60 days prior to performing system tests.

Qualifications; FIO

Proof of qualifications for required personnel. The installer shall submit proof of experience for the Professional Engineer, fire alarm technician, and the installing company.

1.5 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

PART 2 PRODUCTS

2.1 CONTROL PANEL

Control panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for LEDs, zones, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. Separate alarm and trouble LEDs shall be provided for each zone

alarm. These LEDs shall be located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means (single operation) shall be provided for testing the control panel visual indicating devices (meters or LEDs). Meters and LEDs shall be plainly visible when the cabinet door is closed. Signals and LEDs shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Each IDC shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other zones. Loss of power, including batteries, shall not require the reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

Visual annunciators shall be provided for each active zone and spare zone.

1 spare zones shall be provided. Each LED shall provide specific identification of the zone by means of a permanently attached rigid plastic, phenolic, or metal sign with either raised or engraved letters. Zone identification shall consist of a word description of the zone. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate units. Cabinets shall be painted red. Provide Monaco M-2 or approved equal.

2.1.1 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each conductor and terminal marked for identification.

2.2 STORAGE BATTERIES

Storage batteries shall be provided and shall be 24 Vdc sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 72 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 15 minutes. Batteries shall be located at the bottom of the panel. Batteries shall be provided with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. The lock shall be keyed the same as the fire alarm control panel.

2.3 BATTERY CHARGER

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 48 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Charger shall be located in control panel cabinet or in a separate battery cabinet.

2.4 MANUAL FIRE ALARM STATIONS

Manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into signal line circuits. Stations shall be installed on surface mounted outlet boxes. Manual stations shall be mounted at 48 inches. Stations shall be single action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be matched and painted the same color as the fire alarm manual stations.

2.5 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors located in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD. Installed devices shall conform to the NFPA 70 hazard classification of the area where devices are to be installed.

2.5.1 Heat Detectors

Heat detectors shall be designed for detection of fire by fixed temperature . Heat detector spacing shall be rated in accordance with UL 521. Detectors located in areas subject to moisture shall be types approved for such locations. Heat detectors located in attic spaces or similar concealed spaces below the roof shall be intermediate temperature rated.

2.5.2 Smoke Detectors

2.5.2.1 Duct Detectors

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 500 and 4000 fpm. Detectors shall be powered from the fire alarm panel. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 6 feet and those mounted below 6 feet that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches. Remote

lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall have auxiliary contacts to provide control, interlock, and shutdown functions specified in Section 15950 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.6 NOTIFICATION APPLIANCES

Audible appliances shall conform to the applicable requirements of UL 464. Devices shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be painted red. Recessed audible appliances shall be installed with a grill that is painted red with a factory finish to match the surface to which it is mounted.

2.6.1 Alarm Bells

Bells shall be surface mounted with the matching mounting back box surface mounted. Bells shall be suitable for use in an electrically supervised circuit. Bells shall be the underdome type producing a minimum output rating of 85 dBA at 10 feet. Bells used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles. Single stroke, electrically operated, supervised, solenoid bells shall be used for coded applications.

2.6.2 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units, except that they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

2.7 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.7.1 Conduit

Conduit and fittings shall comply with UL 6, UL 1242, UL 797 and Division 16000.

2.7.2 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. Wiring for Fire Alarm circuits shall be No. 14 AWG minimum. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or

T-tap connections to initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited.

2.8 TRANSMITTERS

2.8.1 Radio Alarm Transmitters

Transmitters shall be compatible with proprietary supervising station receiving equipment. Each radio alarm transmitter shall be the manufacturer's recognized commercial product, completely assembled, wired, factory tested, and delivered ready for installation and operation. Transmitters shall be provided in accordance with applicable portions of NFPA 72, NFPA 1221, and 47 CFR 15. Transmitter electronics module shall be contained within the physical housing as an integral, removable assembly. The proprietary supervising station receiving equipment is Monaco D700 and the transceiver shall be fully compatible with this equipment. At the Contractor's option, and if UL listed, the transmitter may be housed in the same panel as the fire alarm control panel. Coordinate transmitter frequency with Base FA shop.

2.8.1.1 Transmitter Power Supply

Each radio alarm transmitter shall be powered by a combination of locally available 120-volt ac power and a sealed, lead-calcium battery.

- a. Operation: Each transmitter shall operate from 120-volt ac power. In the event of 120-volt ac power loss, the transmitter shall automatically switch to battery operation. Switchover shall be accomplished with no interruption of protective service, and shall automatically transmit a trouble message. Upon restoration of ac power, transfer back to normal ac power supply shall also be automatic. Each transmitter shall meet the following requirements: Be compatible with existing Monaco system (Monaco M-2 or Monaco BT2-7).
- b. Battery Power: Transmitter standby battery capacity shall provide sufficient power to operate the transmitter in a normal standby status for a minimum of 72 hours and be capable of transmitting alarms during that period.

2.8.1.2 Radio Alarm Transmitter Housing

Transmitter housing shall be NEMA Type 1. The housing shall contain a lock that is keyed identical to radio alarm transmitter housings on the base. Radio alarm transmitter housing shall be factory painted with a suitable priming coat and not less than two coats of a hard, durable weatherproof enamel.

2.8.1.3 Antenna

The Contractor shall provide omnidirectional, coaxial, halfwave dipole antennas for radio alarm transmitters with a driving point impedance to match transmitter output. The antenna and antenna mounts shall be corrosion resistant and designed to withstand wind velocities of 100 mph.

Antennas shall not be mounted to any portion of the building roofing system.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as shown and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned.

3.1.1 Power Supply for the System

A single dedicated circuit connection for supplying power from a branch circuit to each building fire alarm system shall be provided. The power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

3.1.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.1.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 12 inches nor more than 78 inches above the finished floor. Manually operable controls shall be between 36 and 42 inches above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.1.4 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits as indicated on the drawings. Detectors shall be at least 12 inches from any part of any lighting fixture. Detectors shall be located at least 3 feet from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted

directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 3 feet, sway bracing shall be provided. Detectors installed in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD in a finished, visible location .

3.1.5 Notification Appliances

Notification appliances shall be mounted 80 inches above the finished floor or 6 inches below the ceiling, whichever is lower.

3.1.6 Annunciator Equipment

Annunciator equipment shall be mounted where indicated on the drawings.

3.2 GROUNDING

Grounding shall be provided by connecting to building ground system.

3.3 TESTING

The Contractor shall notify the Contracting Officer at least 10 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise tests. The Contractor shall furnish instruments and personnel required for the tests.

3.3.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing the Contractor shall complete and submit the NFPA 72, Certificate of Completion.

3.3.2 Acceptance Test

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that previous deficiencies have been corrected. The Contractor shall complete and submit the NFPA 72, Inspection and Testing Form. The test shall include all requirements of NFPA 72 and the following:

- a. Test of each function of the control panel.

- b. Test of each circuit in both trouble and normal modes.
- c. Tests of each alarm initiating devices in both normal and trouble conditions.
- d. Tests of each control circuit and device.
- e. Tests of each alarm notification appliance.
- f. Tests of the battery charger and batteries.
- g. Complete operational tests under emergency power supply.
- h. Visual inspection of wiring connections.
- i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.
- j. Ground fault.
- k. Short circuit faults.
- l. Stray voltage.
- m. Loop resistance.

3.4 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period for system expansions and modifications shall consist of at least 1 training day (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15070

SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 General Requirements
 - 1.2.2 Mechanical Equipment
 - 1.2.3 Mechanical Systems
 - 1.2.4 Contractor Designed Bracing
 - 1.2.5 Items Not Covered By This Section
 - 1.2.5.1 Fire Protection Systems (NOT USED)
 - 1.2.5.2 Items Requiring No Seismic Restraints
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 FLEXIBLE COUPLINGS
- 2.2 FLEXIBLE MECHANICAL JOINTS

PART 3 EXECUTION

- 3.1 COUPLING AND BRACING
- 3.2 BUILDING DRIFT
- 3.3 FLEXIBLE COUPLINGS OR JOINTS
 - 3.3.1 Building Piping
 - 3.3.2 Underground Piping

-- End of Section Table of Contents --

SECTION 15070

SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ENGINEERING TECHNICAL INSTRUCTIONS AND ENERGY SAVINGS ANALYSIS

TI 809-04 (1998) Seismic Design for Buildings

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
(SMACNA)

SMACNA Seismic Restraint Mnl (1998) Seismic Restraint Manual Guidelines
for Mechanical Systems

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

The requirements for seismic protection measures described in this section shall be applied to the mechanical equipment and systems listed below. Structural requirements shall be in accordance with Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

1.2.2 Mechanical Equipment

Mechanical equipment to be seismically protected shall include the following items to the extent required on the drawings or in other sections of these specifications:

Storage Tanks for Water	Air Handling Units
Water Heaters	Water and Gas Piping
Valves and Fittings for Piping	Pumps with Motors
Ducts	Exhaust and Return Fans

1.2.3 Mechanical Systems

The following mechanical systems shall be installed as required on the drawings and other sections of these specifications and shall be seismically protected in accordance with this specification:

All Piping Inside the Building Except as Specifically Stated Below

Under "Items Not Covered By This Section".
Fuel Piping Outside of Buildings
All Water Supply Systems
Storm and Sanitary Sewer Systems
All Process Piping
Fuel Storage Tanks
Water Storage Tanks

1.2.4 Contractor Designed Bracing

The Contractor shall design the bracing in accordance with TI 809-04 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads. TI 809-04 uses parameters for the building, not for the equipment in the building; therefore, corresponding adjustments to the formulas shall be required. Loadings determined using TI 809-04 are based on strength design; therefore, the AISC LRFD Specifications shall be used for the design.

1.2.5 Items Not Covered By This Section

1.2.5.1 Fire Protection Systems (NOT USED)

1.2.5.2 Items Requiring No Seismic Restraints

Seismic restraints are not required for the following items:

- a. Gas piping less than 1 inch inside diameter.
- b. All other piping less than 2-1/2 inches inside diameter.
- c. Rectangular air handling ducts less than 6 square feet in cross sectional area.
- d. Round air handling ducts less than 28 inches in diameter.
- e. Piping suspended by individual hangers 12 inches or less in length from the top of pipe to the bottom of the supporting structural member where the hanger is attached, except as noted below.
- f. Ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of the supporting structural member, except as noted below.

In exemptions e. and f., all hangers shall meet the length requirements. If the length requirement is exceeded by one hanger in the run, the entire run shall be braced. Interior piping and ducts not listed above shall be seismically protected in accordance with the provisions of this specification.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation;

submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Coupling and Bracing; FIO. Equipment Requirements; FIO.

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered Engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

SD-04 Drawings

Coupling and Bracing; FIO. Flexible Couplings or Joints; FIO. Equipment Requirements; FIO.

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed.

PART 2 PRODUCTS

2.1 FLEXIBLE COUPLINGS

Flexible couplings shall have same pressure and temperature ratings as adjoining pipe.

2.2 FLEXIBLE MECHANICAL JOINTS

- a. Mechanical couplings for steel or cast iron pipe shall be of the sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movement caused by expansion, contraction, slight settling or shifting of the ground, minor variations in trench gradients, and traffic vibrations. Where permitted in other sections of these specifications, joints utilizing split-half couplings with grooved or shouldered pipe ends may be used.
- b. Sleeve-type couplings shall be used for joining plain-end pipe sections. The coupling shall consist of one steel middle ring, two steel followers, two gaskets, and necessary steel bolts and nuts to compress the gaskets.

PART 3 EXECUTION

3.1 COUPLING AND BRACING

Coupling installation shall conform to the details shown on the drawings. Provisions of this paragraph apply to all piping within a 5 foot line around outside of building unless buried in the ground. Piping grouped for support on trapeze-type hangers shall be braced at the same intervals as determined by the smallest diameter pipe of the group. Bracing rigidly attached to pipe flanges, or similar, shall not be used where it would

interfere with thermal expansion of piping.

3.2 BUILDING DRIFT

Joints capable of accommodating seismic displacements shall be provided for vertical piping between floors of the building, where pipes pass through a building seismic or expansion joint, or where rigidly supported pipes connect to equipment with vibration isolators. Horizontal piping across expansion joints shall accommodate the resultant of the drifts of each building unit in each orthogonal direction. For threaded piping, swing joints made of the same piping material shall be provided.

3.3 FLEXIBLE COUPLINGS OR JOINTS

3.3.1 Building Piping

Flexible couplings or joints in building piping shall be provided at bottom of all pipe risers for pipe larger than 3-1/2 inches in diameter. Flexible couplings or joints shall be braced laterally without interfering with the action of the flexible coupling or joint. Cast iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot pipe joints using rubber gaskets may be used at each branch adjacent to tees and elbows for underground waste piping inside of building to satisfy these requirements.

3.3.2 Underground Piping

Underground piping and 4 inch or larger conduit, except heat distribution system, shall have flexible couplings installed where the piping enters the building.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15200

PIPELINES, LIQUID PROCESS PIPING

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DESCRIPTION
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
- 1.5 APPURTENANCES
- 1.6 PIPE SUPPORTS
- 1.7 GENERAL MATERIAL REQUIREMENTS
- 1.8 Components
- 1.9 Standard Products
- 1.10 Identification
- 1.11 DELIVERY, STORAGE AND HANDLING

PART 2 PRODUCTS

- 2.1 GENERAL
- 2.2 GENERAL MATERIAL REQUIREMENTS
- 2.3 PIPING MATERIALS
- 2.4 PIPE COUPLINGS AND FLEXIBLE PIPE PIECES
- 2.5 VALVES AND ACCESSORIES
- 2.6 THERMAL INSULATION FOR PLUMBING AND PIPING
- 2.7 PIPE SUPPORTS

PART 3 EXECUTION

- 3.1 PIPING INSTALLATION
- 3.2 COUPLING INSTALLATION
- 3.3 INSTALLATION OF VALVES AND ACCESSORIES
- 3.4 INSTALLATION OF PIPE SUPPORTS
- 3.5 PIPE AND VALVE IDENTIFICATION
- 3.6 CLEANING
- 3.7 FIELD TESTING
- 3.8 DISINFECTION OF POTABLE WATER SYSTEMS

-- End of Section Table of Contents --

SECTION 15200

PIPELINES, LIQUID PROCESS PIPING
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI H35.2	(1997) Dimensional Tolerances for Aluminum Mill Products
ANSI H35.2M	(1997) Dimensional Tolerances for Aluminum Mill Products (Metric)

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 5L	(1995; Errata Dec 1997) Line Pipe
-------------	-----------------------------------

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997a) Carbon Structural Steel
ASTM A 47	(1990; R 1995) Ferritic Malleable Iron Castings
ASTM A 47M	(1990; R 1996) Ferritic Malleable Iron Castings (Metric)
ASTM A 48	(1994a) Gray Iron Castings
ASTM A 48M	(1994) Gray Iron Castings (Metric)
ASTM A 53	(1998) Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded, and Seamless
ASTM A 105/A 105M	(1998) Carbon Steel Forgings for Piping Applications
ASTM A 106	(1997a) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 108	(1995) Steel Bars, Carbon, Cold-Finished, Standard Quality

ASTM A 126	(1995) Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A 153/A 153M	(1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167	(1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 181/A 181M	(1995b) Carbon Steel Forgings, for General-Purpose Piping
ASTM A 182/A 182M	(1997c) Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A 183	(1983; R 1998) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(1998) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(1998) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 216/A 216M	(1998) Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A 240/A 240M	(1998) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A 268	(1996) Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service
ASTM A 269	(1996) Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A 276	(1998) Stainless Steel Bars and Shapes
ASTM A 307	(1997) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 312/A 312M	(1995a) Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A 334/A 334M	(1996) Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature

Service

ASTM A 351/A 351M	(1994a) Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts
ASTM A 352/A 352M	(1998) Steel Castings, Ferritic and Martensitic, for Pressure-Containing Parts, Suitable for Low-Temperature Service
ASTM A 395	(1988; R 1998) Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
ASTM A 395M	(1988; R 1998) Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
ASTM A 403/A 403M	(1998) Wrought Austenitic Stainless Steel Piping Fittings
ASTM A 423/A 423M	(1995) Seamless and Electric-Welded Low-Alloy Steel Tubes
ASTM A 436	(1984; R 1997) Austenitic Gray Iron Castings
ASTM A 479/A 479M	(1998) Stainless Steel Bars and Shapes for use in Boilers and Other Pressure Vessels
ASTM A 513	(1997) Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 576	(1990b; R 1995) Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM A 587	(1996) Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry
ASTM A 632	(1990) Seamless and Welded Austenitic Stainless Steel Tubing (Small Diameter) for General Service
ASTM A 727/A 727M	(1997) Forgings, Carbon Steel, for Piping Components with Inherent Notch Toughness
ASTM A 780	(1993a) Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A 789/A 789M	(1995) Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing

	for General Service
ASTM A 813/A 813M	(1995) Single- or Double-Welded Austenitic Stainless Steel Pipe
ASTM A 814/A 814M	(1996) Cold-Worked Welded Austenitic Stainless Steel Pipe
ASTM A 815/A 815M	(1998) Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping Fittings
ASTM A 858/A 858M	(1996) Heat-Treated Carbon Steel Fittings for Low-Temperature and Corrosive Service
ASTM A 865	(1997) Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints
ASTM B 32	(1996) Solder Metal
ASTM B 42	(1998) Seamless Copper Pipe, Standard Sizes
ASTM B 61	(1993) Steam or Valve Bronze Castings
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1997) Seamless Copper Tube
ASTM B 75M	(1997) Seamless Copper Tube (Metric)
ASTM B 88	(1996) Seamless Copper Water Tube
ASTM B 88M	(1996) Seamless Copper Water Tube (Metric)
ASTM B 98/B 98M	(1998) Copper-Silicon Alloy Rod, Bar, and Shapes
ASTM B 124	(1996) Copper and Copper Alloy Forging Rod, Bar, and Shapes
ASTM B 124M	(1996) Copper and Copper Alloy Forging Rod, Bar, and Shapes (Metric)
ASTM B 150	(1998) Aluminum Bronze Rod, Bar, and Shapes
ASTM B 150M	(1995a) Aluminum Bronze Rod, Bar, and Shapes (Metric)
ASTM B 161	(1993) Nickel Seamless Pipe and Tube
ASTM B 164	(1998) Nickel-Copper Alloy Rod, Bar, and Wire

ASTM B 165	(1993) Nickel-Copper Alloy (N04400) Seamless Pipe and Tube
ASTM B 167	(1998) Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06690, N060625, and N06045) Seamless Pipe and Tube
ASTM B 210	(1995) Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B 210M	(1995) Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric)
ASTM B 211	(1995a) Aluminum and Aluminum-Alloy Bar, Rod, and Wire
ASTM B 211M	(1995a) Aluminum and Aluminum-Alloy Bar, Rod, and Wire (Metric)
ASTM B 241/B 241M	(1996) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 247	(1995a) Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings
ASTM B 247M	(1995a) Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings (Metric)
ASTM B 302	(1997) Threadless Copper Pipe
ASTM B 345	(1996) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube for Gas and Oil Transmission and Distribution Piping Systems
ASTM B 345M	(1996) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube for Gas and Oil Transmission and Distribution Piping Systems (Metric)
ASTM B 361	(1995) Factory-Made Wrought Aluminum and Aluminum-Alloy Welding Fittings
ASTM B 366	(1998) Factory-Made Wrought Nickel and Nickel Alloy Fittings
ASTM B 517	(1998) Welded Nickel-Chromium-Iron-Alloy (UNS N06600, N06025, N06045) Pipe
ASTM B 546	(1998) Electric Fusion-Welded Ni-Cr-Co-Mo Alloy (UNS N06617) and Ni-Fe-Cr-Si Alloys

	(UNS N08330 and UNS N08332), Ni-Cr-Fe Alloy (UNS N06025), and Ni-Cr-Fe-Si Alloy (UNS N06045) Pipe
ASTM B 564	(1998) Nickel Alloy Forgings
ASTM B 574	(1998) Low-Carbon Nickel-Molybdenum-Chromium, Low-Carbon Nickel-Chromium-Molybdenum, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Rod
ASTM B 619	(1998) Welded Nickel and Nickel-Cobalt Alloy Pipe
ASTM B 622	(1998) Seamless Nickel and Nickel-Cobalt Alloy Pipe and Tube
ASTM B 725	(1993) Welded Nickel (UNS N02200/UNS N02201) and Nickel-Copper Alloy (UNS N04400) Pipe
ASTM B 775	(1995a) General Requirements for Nickel and Nickel Alloy Welded Pipe
ASTM B 813	(1993) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM B 829	(1996) General Requirements for Nickel and Nickel Alloy Seamless Pipe and Tube
ASTM C 600	(1985; R 1995e1) Thermal Shock Test on Glass Pipe
ASTM D 729	(1995) Vinylidene Chloride Molding Compounds
ASTM D 1418	(1998) Rubber and Rubber Latexes-Nomenclature
ASTM D 1527	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80
ASTM D 1784	(1999) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1996b) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2000	(1998a) Rubber Products in Automotive Applications

ASTM D 2104	(1996) Polyethylene (PE) Plastic Pipe, Schedule 40
ASTM D 2235	(1996a) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2239	(1996a) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D 2241	(1996b) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2282	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)
ASTM D 2310	(1997) Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 2447	(1995) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
ASTM D 2464	(1996a) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1997) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1996a) Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2468	(1996) Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2609	(1997) Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe
ASTM D 2657	(1997) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D 2683	(1998) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D 2737	(1996a) Polyethylene (PE) Plastic Tubing
ASTM D 2774	(1994) Underground Installation of Thermoplastic Pressure Piping

ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2992	(1996) Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings
ASTM D 3035	(1995) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D 3222	(1997) Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials
ASTM D 3261	(1997) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3307	(1998) PFA-Fluorocarbon Molding and Extrusion Materials
ASTM D 3308	(1997) PTFE Resin Skived Tape
ASTM D 3350	(1996) Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3754	(1996) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe
ASTM D 3839	(1994a) Underground Installation of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3892	(1993) Packaging/Packing of Plastics
ASTM D 3965	(1994) Rigid Acrylonitrile-Butadiene-Styrene (ABS) Compounds for Pipe and Fittings
ASTM D 4024	(1994) Machine Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Flanges
ASTM D 4101	(1996a) Propylene Plastic Injection and Extrusion Materials
ASTM D 4161	(1996) "Fiberglass" (Glass-Fiber-Reinforced

	Thermosetting-Resin) Pipe Joints Using Elastomeric Seals
ASTM D 5421	(1993) Contact Molded "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Flanges
ASTM D 5685	(1995) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe Fittings
ASTM D 5686	(1995) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Pipe Fittings, Adhesive Bonded Joint Type Epoxy Resin, for Condensate Return Lines
ASTM E 438	(1992) Glasses in Laboratory Apparatus
ASTM E 814	(1997) Fire Tests of Through-Penetration Fire Stops
ASTM F 336	(1993) Standard Practice for Design and Construction of Nonmetallic Enveloped Gaskets for Corrosive Service
ASTM F 402	(1993) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 423	(1995) Polytetrafluoroethylene (PTFE) Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges
ASTM F 437	(1996a) Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 438	(1997) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F 439	(1998) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 441/F 441M	(1997) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F 442/F 442M	(1997) Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F 477	(1996a) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

ASTM F 491	(1995) Poly(Vinylidene Fluoride) (PVDF) Plastic-Lined Ferrous Metal Pipe and Fittings
ASTM F 492	(1995) Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings
ASTM F 493	(1997) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 599	(1995) Poly(Vinylidene Chloride) (PVDC) Plastic-Lined Ferrous Metal Pipe and Fittings
ASTM F 656	(1996a) Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
ASTM F 714	(1997) Polyethylene (PE) Plastic Pipe (SDR-PR) Based On Outside Diameter
ASTM F 781	(1995) Perfluoro (Alkoxyalkane) Copolymer (PFA) Plastic-Lined Ferrous Metal Pipe and Fittings
ASTM F 876	(1998) Crosslinked Polyethylene (PEX) Tubing
ASTM F 1055	(1998) Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
ASTM F 1056	(1997) Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings
ASTM F 1199	(1988; R 1998) Cast (All Temperatures and Pressures) and Welded Pipe Line Strainers (150 psig and 150 degrees F Maximum)
ASTM F 1200	(1988; R 1998) Fabricated (Welded) Pipe Line Strainers (Above 150 psig and 150 degrees F)
ASTM F 1290	(1998) Electrofusion Joining Polyolefin Pipe and Fittings

ASME INTERNATIONAL (ASME)

ASME B1.1	(1989) Unified Inch Screw Threads (UN and UNR Thread Form)
-----------	---

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B1.20.7	(1991; R 1998) Hose Coupling Screw Threads (Inch)
ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.5	(1996; B16a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B16.9	(1993) Factory-Made Wrought Steel Butt welding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.20	(1993; R 1998) Metallic Gaskets for Pipe Flanges - Ring Joint, Spiral-Wound, and Jacketed
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995; B16.22a) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.28	(1994) Wrought Steel Butt welding Short Radius Elbows and Returns
ASME B16.34	(1997) Valves - Flanged, Threaded, and Welding End
ASME B16.42	(1987; R 1997) Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300
ASME B18.2.1	(1996) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1999) Square and Hex Nuts (Inch

Series)

ASME B31.1	(1998) Power Piping
ASME B31.3	(1999) Process Piping
ASME B36.10M	(1996) Welded and Seamless Wrought Steel Pipe
ASME B36.19M	(1968; R 1994) Stainless Steel Pipe
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

AMERICAN SOCIETY OF SANITARY ENGINEERS (ASSE)

ASSE 1001	(1990) Pipe Applied Atmospheric Type Vacuum Breakers
ASSE 1012	(1995) Backflow Preventers with Intermediate Atmospheric Vent
ASSE 1013	(1993) Reduced Pressure Principle Backflow Preventers
ASSE 1015	(1993) Double Check Backflow Prevention Assembly
ASSE 1020	(1974; Rev thru Feb 1989) Pressure Vacuum Breaker Assembly (Recommended for Outdoor Usage)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75mm Through 1200 mm), for Water and Other Liquids
AWWA C111	(1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1996) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C150	(1996) Thickness Design of Ductile-Iron Pipe
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

AWWA C153	(1994; Errata Nov 1996) Ductile-Iron Compact Fittings, 3 In. Through 24 In. (76 mm Through 610 mm) and 54 In. Through 64 In. (1,400 mm Through 1,600 mm) for Water Service
AWWA C207	(1994) Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
AWWA C500	(1993; C500a) Metal-Sealed Gate Valves for Water Supply Service
AWWA C504	(1994) Rubber-Seated Butterfly Valves
AWWA C508	(1993; C508a) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C509	(1994) Resilient-Seated Gate Valves for Water Supply Service
AWWA C510	(1997) Double Check Valve Backflow-Prevention Assembly
AWWA C511	(1997) Reduced Pressure Principle Backflow-Prevention Assembly
AWWA C540	(1993) Power-Actuating Devices for Valves and Sluice Gates
AWWA C550	(1990) Protective Epoxy Interior Coatings for Valves and Hydrants
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA C651	(1992) Disinfecting Water Mains

AMERICAN WELDING SOCIETY (AWS)

AWS A5.3	(1991) Aluminum and Aluminum Alloy Electrodes for Shielded Metal Arc Welding
AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS A5.10	(1992) Bare Aluminum and Aluminum Alloy Welding Electrodes and Rods
AWS A5.11	(1997) Filler Metal Nickel & Nickel Alloy CVD
AWS A5.14	(1997) Filler Metal Specifications for Nickel and Nickel Alloy Bare Welding

Electrodes and Rods

AWS D1.1 (1998) Structural Welding Code - Steel

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910 Occupational Safety and Health Standards

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA-Restraint Design (1997) Thrust Restraint Design for Ductile Iron Pipe

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 228-1 (1994) Pipe Threads Where Pressure-Tight Joints are not Made on the Threads - Part 1: Dimensions, Tolerances and Designation

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25 (1998) Standard Marking System for Valves, Fittings, Flanges and Unions

MSS SP-43 (1991; R 1996) Wrought Stainless Steel Butt-Welding Fittings

MSS SP-58 (1993) Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69 (1996) Pipe Hangers and Supports - Selection and Application

MSS SP-89 (1998) Pipe Hangers and Supports - Fabrication and Installation Practices

NACE INTERNATIONAL (NACE)

NACE RP0185 (1996) Extruded, Polyolefin Resin Coating Systems With Soft Adhesives for Underground or Submerged Pipe

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 49 (1994) Hazardous Chemical Data

NFPA 325-1 (1994) Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids

NFPA 704 (1996) Identification of the Fire Hazards
of Materials for Emergency Response

RUBBER MANUFACTURERS ASSOCIATION (RMA)

RMA IP-2 (1996) Hose Handbook

SSPC: THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6/NACE 3 (1994) Commercial Blast Cleaning

1.2 DESCRIPTION

Section includes: Provide piping, fittings, supports, and accessories as shown on the Drawings, described in the Specifications and as required to completely interconnect all equipment with piping for complete and operable systems, including equipment drains.

Related Sections Including Work Provided in this Section:

1. Section 02300: Earthwork
2. Section 02510: Water System Piping and Accessories
3. Section 09960: Protective Coatings
4. Section 11001: General Equipment and Mechanical Requirements
5. Section 11003: Disinfection

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Materials and Equipment; FIO. Pipe Supports; FIO.

Manufacturer's descriptive and technical literature for each piping system, including design recommendations; pressure and temperature ratings; dimensions, type, grade and strength of pipe and fittings; thermal characteristics (coefficient of expansion and thermal conductivity); and chemical resistance to each chemical and chemical mixture in the liquid stream.

SD-04 Drawings

Shop Drawings; FIO.

1. Verify by excavation, inspection and measurement all installation conditions for buried pipe before preparation of Shop Drawings. Submit field measurements and photos with Shop Drawings where exposed conditions are significantly different than indicated on the Drawings.
2. Layouts and Schematics: Submit detailed installation drawings of all piping. Schematics may be submitted for piping 4 inches and

smaller. The Drawings and schematics shall include: pipe support locations and types, fittings, valves, other appurtenances.

3. Submit data to show that the following items conform to the Specification requirements:

- a. Pipe, fittings, and accessories.
- b. Fabricated pipe supports and other pipe supports as required herein.
- c. Pipe couplings and flexible pipe pieces.
- d. Valves and Accessories.
4. Submit certified test reports as required herein and by the referenced standard specifications.
5. Pipe, fittings and joint fabrication details for welded steel pipe.
6. Submit procedures for welding field joints of welded steel pipe and welder qualifications.

SD-06 Instructions

Installation; FIO.

The manufacturer's installation recommendations or instructions for each material or procedure to be utilized, including materials preparation.

SD-07 Schedules

Pipe Schedule; FIO.

A list of piping systems, pressure ratings and source of supply for each piping system broken out by material, size and application as indicated on the contract drawings. A list of any special tools necessary for each piping system and appurtenances furnished for adjustment, operation, maintenance and disassembly of the system.

Valve Schedule; FIO.

Operator Schedule; FIO.

A list of valve materials, pressure ratings, valve operator's materials, air supply pressure, electrical service, location, source of supply, and reference identification as indicated in the contract drawings. A list of any special tools necessary for each valve type and appurtenances furnished for adjustment, operation, maintenance and disassembly.

SD-08 Statements

Qualifications; FIO.

A statement certifying that the Contractor has the specified experience.

Welders; FIO.

The names of all qualified welders, their identifying symbols, and the qualifying procedures for each welder including support data such as test procedures used, standards tested to, etc.

Waste Water Disposal; FIO.

The method proposed for disposal of waste water from hydrostatic tests and disinfection, and all required permits, prior to performing hydrostatic tests.

Statement of Satisfactory Installation; FIO.

A signed statement certifying that the installation is satisfactory and in accordance with the contract drawings and specifications and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

SD-13 Certificates

Affidavits; FIO

Furnish affidavits from the manufacturers for the following equipment:

1. Valves operated.
2. All motorized or calibrated equipment.

SD-19 Operation and Maintenance Manuals

Piping and Appurtenances; FIO.

Furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for the following items:

1. Valves 4 inches and larger and all actuated valves.
2. Actuators, including positions and I/P convertors.
3. Filters
4. Pressure regulators

Operation manuals shall detail the step-by-step procedures required for specialized startup, operation and shutdown of piping systems, and shall include the manufacturer's name, model number, parts list and brief description of piping equipment such as valves and other appurtenances and their basic operating features. Maintenance manuals shall list routine maintenance procedures and troubleshooting guides for the equipment, and shall include piping layout and valve locations.

1.4 QUALITY ASSURANCE

A. Materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials and equipment for a period of at least 5 years. Demonstrate to the satisfaction that the quality is equal to the materials and equipment made by the manufacturers specifically named herein, if an alternate manufacturer is proposed.

B. Factory Quality Control: The Contractor shall test all products as noted herein and by the reference specifications.

C. Field Quality Control:
1. The Government will:

- a. Inspect field welds and test the welds if it is deemed necessary.
 - b. Perform bacteriological analysis for pipelines to be disinfected.
2. The Contractor shall:
 - a. Perform leakage tests.
 - b. Be responsible for the costs of additional inspection and retesting by the Government resulting from noncompliance.

1.5 APPURTENANCES

A. Furnish and install all necessary guides, inserts, anchors and assembly bolts, washers and nuts, hangers, supports, gaskets, couplings and flanges; all other appurtenant items shown on the Drawings, specified or required for the proper installation and operation of the piping; devices included in or on the piping equipment; and piping accessories.

1.6 PIPE SUPPORTS

A. General:

1. Piping 6 Inches and Larger: Pipe supports are shown on the Drawings for piping 6 inches and larger in diameter, where the piping is shown on layout drawings. Each pipe support used is designed to resist seismic loading except where the support is of the sliding type for thermal expansion. Other supports are provided to resist axial seismic loading of pipes designed for thermal expansion. The location and types of supports and braces are indicative and may be modified by the Contractor to suit field conditions, provided the modified support system conforms to the design criteria stated herein, and receives the favorable review. Where piping is shown schematically only, it shall be the Contractor's responsibility to support all such piping in accordance with the design criteria stated herein and using support details shown on the Drawings. Pipe supports have been designed assuming flanged joints on ductile iron pipe and steel pipe, unless otherwise indicated on the Drawings. If groove type mechanical couplings are used as an alternative, provide additional supports where required, particularly to resist rotation. Shop drawings of these additional supports shall be favorably reviewed by the Contracting Officer prior to installation.

2. Piping Less Than 6 Inches: Pipe supports are generally not shown for piping less than 6 inches in diameter. Where supports are not shown, it shall be the Contractor's responsibility to support all such piping in accordance with the design criteria stated hereinafter and the support details shown on the Drawings. Piping 2-1/2 inches and larger and all piping for hazardous chemicals shall be supported with pipe supports designed to resist seismic loads, as indicated on the pipe support details. Hazardous chemical piping includes fluoride solution and spare (future chemical). Piping smaller than 2-1/2 inches with non-hazardous contents may be supported with non-seismic resistant supports.

3. Shop Drawings: Submit layout drawings, schematics, and design calculations to demonstrate that support systems that are not as shown

on the Drawings are in accordance with the design criteria.

4. Where not detailed or otherwise indicated, pipe support types and spacing shall be in accordance with the Manufacturer's Standardization Society (MSS) Standard Practice No. SP-58 and No. SP-69, except as superseded by the requirements of these Specifications. Submit Drawings of pipe supports that are not as detailed on the Drawings.

B. Pipe Support System Design:

1. Design Loads: Pipe suspension shall be such as to prevent excessive stress or excessive variation in supporting force while system is in operation. Pipe supports shall support the sum of the weight of the pipe, fittings, appurtenances, and contents. In addition, the pipe shall be anchored to resist internal pressure forces tending to separate any unrestrained joint at pressures 1-1/2 times the maximum working pressure for the applicable service.

2. Seismic Loads: Seismic loads, expressed as a percentage of the weight of the contributing length of pipe, fittings, appurtenances, and contents, are 45% in any direction within the horizontal plane of the pipe, and 23% up or down within the vertical plane of the pipe.

3. Location: All piping shall be supported in a manner which will prevent undue strain on any valve, fitting, or piece of equipment. In addition, pipe supports shall be provided at changes in direction or elevation, adjacent to flexible couplings, at all nonrigid joints, at hose bibbs, and where otherwise shown. Where piping connects to equipment, it shall be supported by a pipe support and not by the equipment.

a. Maximum support spacing shall conform to the following table:

<u>Pipe Size Inches</u>	<u>Pipe Material</u>	<u>Maximum Spacing (Feet)</u>
1" & Smaller	Iron or Steel	6
	Copper	4-1/2
	Plastic	Continuous
	Tubing	Continuous
1-1/4 to 2"	Iron or Steel	8
	Copper or Plastic	5
2-1/2 to 4"	Iron or Steel	10
	Copper or Plastic	6
6-8"	Iron or Steel	12
	Plastic	8
10" or Larger	Iron or Steel	15

b. Piping penetrations through concrete walls and slabs are considered to resist seismic loading, provided penetrations for pipes 3 inches in diameter and larger are complete with a wall flange.

c. Branch piping is not considered to provide resistance to

seismic forces.

4. Anchors: Anchors for connecting pipe supports to concrete shall be in accordance with Section 05500.

5. Thermal Expansion Allowance:

a. Provide one rigid pipe support for each straight run of pipe and between each pair of flexible couplings, flexible connectors, or expansion loops for pipes listed below. PVC pipe larger than 1-inch in diameter shall allow sliding inside PVC sleeve, along the pipe axis.

b. Provide vertical support only, that is, no lateral support, within 4 feet of an angle or tee for pipes listed above.

1.7 GENERAL MATERIAL REQUIREMENTS

Piping materials and appurtenances shall be as specified and as shown on the drawings, and shall be suitable for the service intended. Piping materials, appurtenances and equipment supplied as part of this contract shall be new and unused except for testing equipment. Components that serve the same function and are the same size shall be identical products of the same manufacturer. The general materials to be used for the piping systems are indicated by service in the contract drawings

1.8 Components

Piping equipment and appurtenances shall be new products of equal material and ratings as the connecting pipe.

1.9 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacturing of the products and shall essentially duplicate items that have been in satisfactory use for at least 5 years prior to bid opening. Nominal sizes for standardized products shall be used. Pipe, valves, fittings and appurtenances shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

1.10 Identification

Each piece of pipe shall bear the ASTM designation and all other markings required for that designation. Valves shall bear a securely attached tag with the manufacturer's name, valve model number, and valve identification permanently displayed and be marked in accordance with MSS SP-25.

1.11 DELIVERY, STORAGE AND HANDLING

Materials delivered and placed in storage shall be stored with protection from the weather, excessive humidity variation, excessive temperature variation, dirt, dust and/or other contaminants. Proper protection and care of material before, during and after installation is the Contractor's responsibility. Any material found to be damaged shall be replaced at the Contractor's expense. During installation, piping shall be capped to keep

out dirt and other foreign matter. A material safety data sheet in conformance with 29 CFR 1910 Section 1200(g) shall accompany each chemical delivered for use in pipe installation. At a minimum, this includes all solvents, solvent cements, glues and other materials that may contain hazardous compounds. Handling shall be in accordance with ASTM F 402. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1. Materials shall be stored with protection from puncture, dirt, grease, moisture, mechanical abrasions, excessive heat, ultraviolet (UV) radiation damage, or other damage. Pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendation. Plastic pipe shall be packed, packaged and marked in accordance with ASTM D 3892.

PART 2 PRODUCTS

2.1 GENERAL

- A. Pipe and valve sizes are nominal inside diameter unless otherwise noted.
- B. Construct vents of materials specified for the pipe system for which they serve.
- C. All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.
- D. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the completed product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified hereinafter.
- E. Cutoff Flanges: Provide at all pipe penetrations for pipes 4 inches and greater in nominal diameter, and at all penetrations of 3-inch and smaller nominal diameter pipe in wet or potentially wet locations as indicated on the Drawings. Cutoff flange outside diameter shall be at least a standard connection flange's outside diameter except that for pipe 30-inch-diameter and larger, nominal size, cutoff flange outside diameter may be 6 inches greater than outside pipe diameter. Cutoff flange shall be at least 1/4-inch thick and shall be continuously welded (or cast) onto the pipe.

2.2 GENERAL MATERIAL REQUIREMENTS

- A. Gaskets: Unless specifically specified otherwise, all gaskets shall be chloroprene.
- B. Bolts and Tie Rods: Unless specified otherwise herein, flange bolts and nuts, coupling bolts and nuts, tie rods and other hardware shall be as follows:
 - 1. Exposed: Electroplated zinc or cadmium steel.
 - 2. Concrete Encased: Steel.
 - 3. Buried: Type 304 stainless steel, minimum tensile strength: 60,000 psi.

4. Apply an anti-seize compound to the threads of stainless steel bolts.
5. Submerged: Type 304 stainless steel, minimum tensile strength: 60,000 psi.

C. Fusion Epoxy Coating: AWWA C213; except application shall be by fluid bed only unless the greatest dimension of the article to be coated exceeds ten feet, in which case electrostatic spray application may be used.

D. Flexible Sealant: Flexible sealant for pipe joints, where shown on the drawings, shall be a two-component polysulfide, non-sag; Silkaflex 412, Dualthane, or equal.

2.3 PIPING MATERIALS

A. Pipe and Fitting Designation: Piping materials are identified by a "Type" designation in these Specifications. The "Type" designation identifies not only the pipe itself, but the associated fittings and appurtenances and the installation and test procedures described for that "Type." The designation of a particular type shall indicate a complete installation including fittings, joints, cleaning and testing. The "Type" designation is alpha-numeric and is written in the form "Type A-1 Pipe" or "TA-1P". The pipe and fitting materials for each type designation shall be as specified herein and summarized in the Pipe Type Schedule.

B. Piping Identification Schedule: Piping systems and their corresponding piping and valve systems are listed on Drawing G3.0.

Material

BS	Black and Carbon Steel
CISP	Cast Iron Soil Pipe
Cu	Copper
DI	Ductile Iron
FE	Fiberglass/Epoxy
GS	Galvanized Steel
PE	Polyethylene
PVC	Polyvinyl Chloride
SS	Stainless Steel
WS	Welded Steel
PP	Polypropylene
SCI	Silicon Cast Iron
VC	Vitrified Clay

Service

B	Buried	In contact with soil
C	Concrete	Encased In contact with concrete
E	Exposed	In contact with the atmosphere
S	Submerged	Continuously or intermittently in contact with water

Flow

G = Gravity Pipes flowing partially full due to gravity forces
 P = Pressure Pipes which are continuously or intermittently flowing full due to pumping or gravity forces

C. Pipe Type Schedule: Pipe material, joints and fittings shall be as summarized below. A detailed specification of each pipe type follows. (The detailed specification supersedes the schedule in case of any conflicts.)

<u>Pipe Type</u>	<u>Pipe Material</u>	<u>Field Joints</u>	<u>Fittings</u>
A-3	Reinforced Concrete	B & S	----
F-1	Corrugated Metal	Band	----
M-2	WS, Fusion Epoxy Lined (Coated Welded Steel Pipe	Weld (Flanged Where Shown)	WS DI or Cl
N-1	DI (Ductile Iron), Cement Mortar Lined	Flanged or Restrained Mechanical Joints	DI or Cl
N-2	DI, Cement Mortar Lined	Flanged	DI or Cl
T-1	Copper	Solder or Flare	Wrought Copper or Bronze
V-1	PVC, Schedule 80	Solvent Weld	PVC, Schedule 80
V-5	PVC, Sewer	B & S	PVC
Y-1	Galvanized Steel	Thread	Galvanized Malleable Iron

D. Type A-3 Pipe:

1. Pipe: Reinforced concrete storm drain, ASTM C76 except as modified herein, Class 4.
2. Joints: O-Ring Gasketed bell and spigot, all concrete, with bell cast integrally with the pipe, ASTM C443.
3. Joints: Tongue and groove, cement mortared.
4. Cement: Type II.
5. Gaskets: Sewage and grease resistant chloroprene.
6. Mortar: One part Type II portland cement to two parts sand.
7. Factory Tests:
 - a. Acceptance of the pipe shall be based on Paragraph 5.1.1, 5.1.2 of ASTM C76 including both the 0.1-inch crack test and the ultimate strength tests. Prior to shipment of pipe, the manufacturer shall conduct the 0.01-inch crack and ultimate load tests on one pipe section sample of each class and diameter to be installed.
 - b. Joint Tests: Test two sections of each diameter in accordance with ASTM C443, Paragraph 9.

E. Type M-2 Pipe:

1. Pipe: Welded Steel, AWWA C200.
 - a. Dimensions: Nominal inside diameter shall be the minimum net inside clear lined diameter, except that net inside clear lined diameter may be up to 1/2-inch less than the nominal diameter for nominal diameter 12-inch or less.
 - b. Minimum steel cylinder thickness and lining thickness:

Nominal Size (Inches)	Steel Cylinder Minimum Wall Thickness (Inches)	Minimum Lining Thickness (Inches)
4-8	0.135	3/8
(10-16)	0.188	1/2

(18-48)	0.250	3/4
(51-60)	0.312	3/4

For tapered sections, minimum cylinder thicknesses shall conform to the requirements for the larger pipe diameter.

2. Field Joints: Flanged. No field welding is permitted.
 - a. Welded joints shall be butt welded. The joint shall be designed to withstand all loads associated with installation and operating conditions. Joint welding shall conform to the requirements of AWWA C206 except Section 6-2 testing, which is modified herein.
3. Fittings: Fittings shall be Schedule 40 steel, butt weld ends, except pipe 12 inches diameter and larger may be Schedule 20.
4. Lining and Coating: Shop fabricate assemblies less than 10 feet in maximum dimension. Fusion epoxy after fabrication by the immersion method in accordance with AWWA C213. After fusion of epoxy coating, the fusion epoxy coating shop shall lightly grit sweep blast the exterior of the assemblies without removing coating to the substrate, to provide a mechanical bond for the finish coat to be field applied.
5. Flanges: Schedule 40 butt welding flanges with bolt holes drilled in conformance with ANSI B16.1, 125-pound class. Bolts shall be sized in accordance with ANSI B16.1. Flange gaskets shall be as specified for Type N-2 Pipe.
6. Factory Testing: Hydrostatic pressure tests shall be performed in accordance with Section 3.4 of AWWA C200. Specials shall be tested in accordance with Section 4.3 of AWWA C200. The test method shall be subject to the favorable review of the Contracting Officer. Submit test results for information.
7. Marking: Match mark assemblies for field installation.

F. Type N-1 Pipe:

1. Pipe: Ductile iron, AWWA C151.
 - a. Thickness:

Pipe Size (inches)	Thickness Class
3 & 4	51
6-24	50
2. Joints: Push-on or mechanical, AWWA C111 as modified.
 - a. Gaskets: Chloroprene.
 - b. Buried Tee-Head Bolts and Nuts: Ductile iron, cor-ten, or Type 304 stainless steel.
3. Fittings: Ductile iron or cast iron.
 - a. Push-on joints, AWWA C110.
 - b. Mechanical joints, AWWA C110 or
 - 1) AWWA C110 except dimensions and thicknesses. Thickness shall be ductile iron Class 53 or greater. U.S. Pipe Trim Tyte, Nappco, or equal.
4. Lining: Standard thickness cement mortar lining for pipe and fittings, AWWA C104, except where noted otherwise in the Drawings or in the Piping Identification Schedule.

G. Type N-2 Pipe:

1. Pipe: Ductile iron.

- a. Flanged Pipe: AWWA C115 including Appendix A, minimum thickness Class 53.
- b. Grooved End Pipe: AWWA C151 with grooves in accordance with AWWA C606, Table 5, for rigid joints. Minimum thickness classes in accordance with AWWA C606 are:

Nominal Pipe Size (inches)	Minimum Thickness Class
4-16	53

- 2. Joints: Flanged except where mechanical grooved couplings are required on the Drawings.
- 3. Flanges: Ductile iron, plain faced, AWWA C115. Submit certification that flanges comply with AWWA C115.
- 4. Mechanical Grooved Couplings: AWWA C606, minimum pressure rating of 150 psi.
- 5. Fittings:
 - a. Flanged: Ductile iron, AWWA C110.
 - b. Grooved End: Ductile iron, AWWA C110 for materials, dimensions and pressure ratings. Grooves shall be in accordance with AWWA C606, Table 5, for rigid joints.
 - c. Special Fittings: Special fittings not available in ductile iron or cast iron pipe may be fabricated of fusion epoxy lined and coated welded steel pipe (Type M-2 Pipe) with a design pressure of 450 psi. Submit design and wall thickness to the Contracting Officer for review.
- 6. Gaskets:
 - a. Flanged: Full face, 1/8-inch-thick chloroprene, AWWA C115, Appendix A.
 - b. Mechanical Grooved Coupling: Nitrile or neoprene, AWWA C606.
- 7. Flange Bolts: AWWA C115, Appendix A, unless stainless steel is required in paragraph 2.02.
- 8. Pipe Taps:
 - a. Threaded pipe branch lines up to 1 inch in diameter from ductile iron pipe may be made with direct threaded taps, provided the ductile iron wall thickness is in excess of the minimum shown in Tables A.1 and A.2 of AWWA C151 for four full threads. Bosses may be used at the taps to provide the required pipe wall thickness, or use service saddles or reducing flanges on tees.
 - b. Service Saddles:
 - 1) Materials: Ductile iron saddle with electro-galvanized straps and hardware, and neoprene gaskets.
 - 2) Type: For ductile iron pipe 4 inches and less, single strap saddles may be used. For pipe greater than 4-inch, double strap saddles shall be used.
 - 3) Manufacturers: Rockwell International Model 311 or 313; R. H. Baker and Company Series 180-0; or equal.

H. Type T-1 Pipe:

- 1. Pipe: Copper, ASTM B88.
 - a. Buried: Type K (soft drawn).
 - b. Exposed: Type L (hard drawn).
- 2. Joints:
 - a. Buried: Soldered or flared.
 - b. Exposed: Soldered.
- 3. Solder: ASTM B32, alloy grade E or HB. Solder and flux shall

contain less than 0.2% lead.

4. Fittings:

- a. Soldered: Wrought copper, ANSI B16.22; or cast bronze, ANSI B16.18.
- b. Flared: AWWA C800 and ANSI B16.26

I. Type V-1 Pipe:

1. Pipe: Schedule 80 polyvinyl chloride (PVC), gray, normal impact, Type 12454 B, ASTM D1784 and ASTM D1785. Pipe shall bear the National Sanitation Foundation (NSF) label.
2. Joints: Solvent weld, except flanged or threaded permitted where required at equipment connections and where required on the Drawings.
3. Fittings: Solvent weld, socket type, of same material as the pipe, Schedule 80, ASTM D2467 or threaded PVC Plastic Pipe Fittings, ASTM D2464, Schedule 80.
4. Cement: Solvent weld, ASTM D2564, as recommended by the pipe manufacturer for the schedule and size to be joined.
5. Pipe Cleaner: As recommended by the pipe manufacturer for the schedule and size to be joined.

J. Type V-5 Pipe:

1. Pipe and Fittings: Polyvinyl chloride sewer pipe:
 - a. 4-inch through 15-inch nominal size: ASTM D3034, SDR 35.
 - b. 18-inch through 27-inch nominal size: ASTM F679.
2. Joints: Elastomeric gasket joints, ASTM D3212.
3. Gaskets: Chloroprene, ASTM F477.
 - a. Submit two sample gaskets with an explanation of the markings.

K. Type Y-1 Pipe:

1. Pipe: Galvanized steel, ASTM A53, Schedule 40.
2. Fittings:
 - a. Pressure Pipe Service: Galvanized malleable iron, screwed, ASTM A197 for materials, ANSI B16.3 150 psi for dimensions.
 - b. Drain Pipe Service: Galvanized cast iron drainage pattern, ANSI B16.12.
3. Threads: ANSI B2.1.
4. Unions: Galvanized malleable iron, ASTM A197 for materials and ANSI B16.39 for dimensions, with brass seats.
5. Thread Compound: Permatex No. 2, Crane equivalent; or equal, or teflon tape.

2.4 PIPE COUPLINGS AND FLEXIBLE PIPE PIECES

A. General: For typical pipe joints refer to pipe material

specifications. Other joint devices shall be furnished where called for as specified below.

B. Flexible Couplings and Flange Coupling Adaptors:

1. Sleeve: Cast iron or fabricated steel.
2. Followers: Cast iron, ductile iron, or steel.
3. Sleeve Bolts: ASTM A325, Type 3; malleable iron; or equivalent.
4. Coating: Fusion epoxy line and coat sleeve and followers.
5. Pressure Rating: 1-1/2 times the test pressure of the applicable service or 25 psi, whichever is greater.
6. Manufacturers:

- a. Flexible Couplings:
 - 1) Connecting Pipe with Identical Outside Diameters:
Smith-Blair 411 or 441; Dresser Style 38 or 53; or equal.
 - 2) Connecting Pipe with Slightly Different Outside Diameters:
Smith-Blair 413 or 441; Dresser Style 162; or equal.
 - b. Flange Coupling Adaptors: Smith-Blair 912 or 913; Dresser Style 127 or 128; or equal.
 - 7. Gaskets: Oil and grease resistant; Smith-Blair Grade 60; Dresser Grade 42; or equal.
 - 8. Joint Restraint: Provide joint harnesses designed for the test pressure across all flexible couplings and flange coupling adaptors, except where specifically indicated otherwise on the Drawings, where shown on the drawings. For steel pipe the joint harness shall conform to the requirements of Chapter 13 of AWWA M-11. Anchor studs may be used for pipe up to 12 inches in diameter.
- C. Mechanical Groove Couplings:
- 1. Application: Mechanical couplings (segmental clamp joints) shall be used wherever shown on the Drawings. They may be substituted for flanged joints on steel pipe if favorably reviewed by the Contracting Officer and may be substituted for flanges on all ductile iron pipe.
 - 2. Type: AWWA C606, pressure rated at least 300 psi.
 - 3. Joints: Cut groove, except shoulder joints may be used for steel pipe where the wall thickness of the pipe is less than that allowed by Table 3 (AWWA C606). Only Type B, Type C, and Type D special ends are acceptable for shoulder joints.
 - 4. Grooves:
 - a. Ductile Iron Pipe where Mechanical Groove Couplings are shown on the Drawings: Flexible joint, Table 2 (AWWA C606).
 - b. Ductile Iron Pipe where Flanges are shown on the Drawings: Rigid joint, Table 5 (AWWA C606).
 - c. Steel Pipe: Table 3 (AWWA C606).
 - 5. Gaskets: Nitrile.
- D. Flexible Rubber Spools:
- 1. Up to 12-inch Diameter:
 - a. Type: Molded spherical rubber expansion joints with full rubber flanges and retainer rings.
 - b. Materials: Neoprene reinforced with nylon or polyester body and galvanized steel retainer rings. Protect cover with hypalon paint.
 - c. Pressure Rating: 190 psi.
 - d. Manufacturers: Holz Spanflex Model SFR, Garlock EZ-FLO Style 206, or equal.
 - 2. Larger than 12-inch Diameter:
 - a. Type: Built-up, single arch (unless otherwise shown on Drawings) with full rubber flanges and retaining rings.
 - b. Materials: Neoprene reinforced with nylon or polyester body and galvanized steel retainer rings. Protect cover with hypalon paint.
 - c. Pressure Rating: 80 psi.
 - d. Manufacturers: Holz Model 300 HP, Garlock Style 204HP, or equal.
 - 3. Restraint: Provide galvanized steel control rod-compression

sleeve assemblies for all flexible spools, except where pipelines cross structural expansion joints or where specifically omitted by note in the Drawings. Number and size of control rods shall be as required for the test pressure of the pipe system or 150 psi, whichever is greater.

2.5 VALVES AND ACCESSORIES

- A. Valve Designation: Valves shall be as shown on the Drawings.
- B. General Requirements for Valves:
 - 1. All valves of each type shall be the product of one manufacturer.
 - 2. All valves shall be furnished with operators, handwheels, levers, or other suitable type wrench including handles as specified herein or as shown on the Drawings. Valves 4-inch and larger located more than 7 feet above the floor level shall be furnished with chain operators. Chains shall be galvanized and shall extend to within 3 feet of the floor. Provide hook so that chain may be stored clear of walkways.
 - 3. All threaded stem valves shall open by turning the valve stem counter-clockwise.
 - 4. All exposed valves and valve operators shall have a non-bleeding shop coat, unless otherwise specified. Buried valves and operators shall be fusion bonded epoxy coated.
 - 5. Valve Pneumatic and Hydraulic Actuators: (NOT USED)
 - 6. Motor Actuators: Comply with AWWA C540. Provide integral electrical controls with indicating lights and local-off-remote selector switch. Remote control shall be as shown on instrument drawings.
- C. General Requirements for Accessories:
 - 1. Pressure Gauges: Provide shutoff valves for all pressure gauges. Conform to additional requirements in this Section below.
- D. Valve and Accessory Systems:
 - 1. Valve and Accessory System A:
Applicable Service Condition: Clean Water and air.
 - a. Gate Valves through Size 2-inch:
 - 1) Rating: 200 psi WOG.
 - 2) Type: Rising stem, screw in bonnet, solid wedge disc, handwheel operated.
 - 3) Connections: Threaded.
 - 4) Materials: All bronze.
 - 5) Manufacturers: Jenkins Figure 47; Crane No. 428; or equal.
 - b. Gate Valves 2-1/2 through 12-inch
 - 1) Rating: 200 psi WOG.
 - 2) Type: Rising stem, O.S. and Y, solid wedge, handwheel operated.
 - 3) Connections: Flanged, 200 psi WOG.
 - 4) Materials: Cast iron, bronze trimmed.
 - 5) Manufacturers: Mueller, or equal.
 - c. Globe Valves through size 3-inch:
 - 1) Rating: 300 psi WOG.
 - 2) Type: Union bonnet, composition or teflon disc, handwheel operated, straight or angle pattern.

- 3) Connections: Threaded.
- 4) Materials: All bronze.
- 5) Manufacturer: Jenkins 106A; Crane 7TF, or equal.
- d. Ball Valves through size 2-inch in metal piping:
 - 1) Rating: 400 psi WOG.
 - 2) Type: Lever.
 - 3) Connections: Threaded.
 - 4) Materials: Bronze body and ball, teflon seats.
 - 5) Manufacturers: Jenkins 32A, Crane 2330TF, or equal.
- e. Swing Check Valves through size 2-inch:
 - 1) Rating: 300 psi WOG.
 - 2) Type: Swing, composition disc.
 - 3) Connections: Threaded.
 - 4) Materials: All bronze.
 - 5) Manufacturers: Jenkins 352; Crane 141; or equal.
- f. Swing Check Valves 2-inch and larger:
 - 1) Rating: 175 psi up to 12-inch, 150 psi for 14-inch to 24-inch.
 - 2) Type: Swing, metal seats, outside spring and lever, AWWA C508.
 - 3) Connections: Flanged, 125-pound ANSI.
 - 4) Materials: Cast iron, bronze trim.
 - 5) Manufacturers: M & H Style 259; equivalent by Clow; or equal.
- g. Silent Check Valves 2-inch and larger:
 - 1) Rating: 175 psi minimum, up to 12-inch, 150 psi minimum for 14-inch to 24-inch.
 - 2) Type: Silent, AWWA C508.
 - 3) Connections: Flanged, 125-pound ANSI.
 - 4) Materials: Cast iron, bronze trim.
 - 5) Manufacturers: APCO Series 300, or equivalent Valmatic model, or equal.
- h. Pressure Gauge Assembly:
 - 1) Complete assembly shall include 3/4-inch isolation ball valve or a gauge cock, pulsation dampeners or snubbers. Provide a support plate to the nearest flange.
 - 2) Pressure gauges shall have a dial size not less than 4-1/2 inches, flangeless case, bronze brushed movement, phosphor bronze or stainless steel bourdon tube, 1% accuracy, friction mounted adjustable pointer, black figures on white dial, glass or acrylic window. Label face of dial to identify unit of measurement. Complete gauge shall be U.S. Gauge 1980 Series; Trerice Series 450; or equal.
 - 3) Gauge cocks shall be stainless steel needle valves, Trerice 865; Marsh Type 1936; or equal.
 - 4) Pulsation dampeners and snubbers shall be stainless steel for the specific service involved, air or water, and shall be Trerice No. 870; or equal.
- i. Solenoid Valves: Valves shall be for 150-psi water pressure, 120-volt ac service, with a watertight enclosure. Valve body shall be brass, seats Buna-N, with stainless steel plug. Valves shall be normally closed. Provide manual override control. Valves shall be ASCO Bulletin 8211, Skinner L or R Series, or equal.

- j. Rotameters: (NOT USED).
- k. Butterfly Valves:
 - 1) Standard: AWWA C504, except as modified herein.
 - 2) Type:
 - a) 3-inch through 12-inch: Wafer body, spring assisted except short body flanged where shown as flanged on the Drawings, or where buried.
 - b) 12-inch and larger: Short body flanged.
 - 3) Pressure Class:
 - a) 3-inch through 12-inch: 150 B.
 - b) 12-inch through 72-inch: 150 B, unless shown otherwise on the Drawings.
 - c) Valves shall be bubble tight at rated pressure in either direction.
 - 4) Materials:
 - a) Body: Cast Iron; ASTM A126, Class B, or ASTM A48, Class 40.
 - b) Disk: Cast or ductile iron with Ni-Chrome, ENP or Type 316 Stainless steel edge, 316 Stainless steel.
 - c) Seats: Buna-N.
 - d) Valve Shaft: Type 304 or Type 316 Stainless steel.
 - 5) Construction:
 - a) Seats: Applied to body. Cartridge type seats with retaining rings are not acceptable.
 - b) Shaft Connection: Disk to shaft connection shall be stainless steel pins, 316 Stainless steel torque plug, 316 Stainless steel screws, or approved "pin-less" design.
 - c) Shaft: Both ends of the shaft shall be scribed to indicate valve position.
 - 6) Finish:
 - a) Exposed Exterior: Shop prime compatible with field applied finish coats.
 - b) Buried Exterior: Shop coat with coal tar epoxy, 16 mils minimum.
 - c) Interior, smaller than 24 inches: Asphalt varnish in accordance with AWWA C504.
 - d) Interior, 24 inches and larger: Shop line with two-component, high solids epoxy.
 - 7) Testing: Test in accordance with AWWA C504, except that leakage test shall be in both directions. Submit certified test results for tests specified in Sections 3.8 and 5.2 for valves 24 inches and larger.
 - 8) Actuators:
 - a) Type: Manual, except where specified otherwise, or shown otherwise on the Drawings. Refer to instrumentation drawings. Provide valve position indicators on all actuators.
 - b) Manual Actuators: Traveling nut, self-locking, or worm gear above 48 inches.
 - (1) Buried: Designed for buried service, watertight up to 10 psi. Provide 2-inch square standard AWWA operating nut, with extension stem to reach the ground surface as shown on the Drawings, and with a ground level position indicator.
 - c) Pneumatic and Hydraulic: (NOT USED)
 - d) Motor: See Paragraph 2.5B.6

9) Manufacturer:

Size Range	Type	First Name	Second Name or Equal
3"-12"	Wafer (Filter Piping)	Keystone ARI	Bray Series 30/31
3"-20"	Flanged (or service other than filter piping)	Pratt, 2FII or Pratt Groundhog (buried)	Keystone Series 504/506

l. Combination Air Release Valves:

- 1) Rating: 300 psi water.
- 2) Type: 1-inch size, combination air vacuum and air release valve.
- 3) Connections: Threaded
- 4) Materials: Cast iron body, synthetic rubber seat, stainless steel trim and float.
- 5) Manufacturers: APCO model 143C equivalent Val-Matic; or equal.

m. Backflow Preventor: Reduced Pressure type, size as shown on the Drawings. Headloss shall not exceed 14-psi maximum flow. Backflow preventer shall be ClaVal Model RP-4, equivalent Fabco, or equal.

n. Combination pressure reducing and pressure sustaining valve:

- 1) Type: Globe style, flanged ends, pilot controlled, diaphragm actuated.
- 2) Pressure Rating: 150 psi.
- 3) Materials: Valve shall be ductile iron or stainless steel body. Ductile iron body shall be fusion body epoxy coating. Disc guide, seat and cover bearing shall be bronze. Disc shall be Buna-n rubber and the Diaphragm shall be Nylon reinforced Buna-N rubber. The stem nut and springs shall be stainless steel.
- 4) Control: Valve to maintain constant downstream pressure regardless of flow. Valves with pressure sustaining pilot control senses upstream pressure; valve opens immediately when pressure exceeds setpoint and closes slowly when pressure falls below the setpoint.
- 5) Features: Provide for constant downstream pressure regulation based on an adjustable setting. All pilot feed lines shall be equipped with a wye strainer. Valve shall be equipped with additional pressure sustaining pilot as listed below:

Pressure Reducing Valve Pilot Settings

<u>Valve Number</u>	<u>PRV-1</u>	<u>PRV-2</u>	<u>PRV-3</u>
Valve Size	10-inch	10-inch	4-inch
Pressure Reducing Spring Range; Factory Setting	30-300 psi; 75 psi	3-30 psi; 15 psi	3-30 psi; 15 psi
Pressure Sustaining Spring Range; Factory Setting	20-200 psi; 85 psi	NA	20-200 psi; 85 psi

6) Manufacturer: Cla-Val, or equal.

o. Ball Curb Valves:

- 1) Rating: 300 psi water.
- 2) Type: Copper service thread both ends.
- 3) Manufacturer: Mueller Co., or equal.

2. Valve and Accessory System B: NOT USED

3. Valve and Accessory System C:

a. Applicable Service Conditions: PVC piping with contents at pressures to 150 psi and temperatures to 75° F.

b. Ball Valves Through 4-inch Size:

- 1) Rating: 150 psi at 75°F.
- 2) Type: Double union.
- 3) Connections: Socket.
- 4) Materials: PVC body, teflon seats and EPDM O-ring seals, except Viton O-ring seals with chlorine solution.

5) Manufacturers: R&G Sloan, Asahi/America Pro Block, or equal.

c. Check Valves Double Union Type:

- 1) Rating: 150 psi at 75°F.
- 2) Type: Ball for horizontal or vertical service.
- 3) Connections: Union ends for socket weld.
- 4) Materials: PVC body, Viton O-ring seals.
- 5) Manufacturers: Chemtrol True Union BC, Plastiline No. 8611, or equal.

d. Strainers:

- 1) Rating: 150 psi.
- 2) Type: Wye-type basket strainers. Strainer screen size as recommended by feed pump supplier.
- 3) Connections: Threaded.
- 4) Materials: PVC.
- 5) Manufacturers: Chemtrol, GF, or equal.
- 6) Installation: Each to be installed with ball valve blowoff and piping to drain.

e. Pressure Gauges:

- 1) Complete installation, unless otherwise shown, shall include ¾-inch plug valve isolation at the main, a gauge protector made specifically for the intended service, a snubber and gauge. Provide a support plate to the nearest flange.

- 2) Plug Valve: Shall be Lunkenheimer Figure 454, James Jones equivalent, or equal, for sizes below ½-inch diameter. Connections shall be threaded.
 - 3) Protector: Shall be for the intended service with flushing connection. Body shall be steel or cast iron. Diaphragm shall be removable and shall be suitable for use with chlorine solution. Complete unit shall be Trerice, M & G (U.S. Gauge), or equal.
 - 4) Gauges and Snubbers: Shall be as specified for System A.
 - 5) All gauges installed in chlorine solution lines shall be provided with a shutoff valve between the snubber and the pipeline. These shutoff valves shall be ¼-inch, Type 1, Grade 1 PVC with Viton stem seal and Teflon seat, Chemtrol CN series, Plastiline, GSR, or equal.
 - 6) Installation: All protectors and gauge bourdon tubes shall be evacuated of air, glycerine filled at the factory and factory calibrated. On all pump discharges, snubbers or pulsation dampeners shall be installed between the top of protector and the gauge.
4. Valve and Accessory System D: NOT USED
 5. Valve and Accessory System E:
 - a. Applicable Service Conditions: Clean water at pressures to 150 psi and temperatures to 150°F utilizing copper piping.
 - b. Gate Valves through 2-1/2-inch:
 - 1) Rating: 200 psi water.
 - 2) Type: Rising stem, solid wedge.
 - 3) Connections: Solder ends for copper pipe.
 - 4) Materials: All bronze.
 - 5) Manufacturers: Jenkins Figure 1242, Crane No. 1334, or equal.
 - c. Globe Valves through 2-1/2-inch:
 - 1) Rating: 200 psi water.
 - 2) Type: Renewable disc, globe or angle.
 - 3) Connections: Solder ends for copper pipe.
 - 4) Materials: All bronze.
 - 5) Manufacturers: Jenkins Figure 1200 or Figure 1202, Crane No. 1310. or equal.
 - d. Check Valves through 2-1/2-inch:
 - 1) Rating: 200 psi water
 - 2) Type: Regrinding swing check.
 - 3) Connections: Solder ends for copper pipe.
 - 4) Materials: Bronze with bronze or brass disc.
 - 5) Manufacturers: Jenkins Figure 1222, Crane No. 1342, or equal.
 - e. Ball Valves shall be as specified under Valve System A.
 - f. Strainers shall be as specified under Valve and Accessory System A.
 6. Valve and Accessory System F: NOT USED
 7. Valve and Accessory System G: NOT USED

8. Valve and Accessory System H: NOT USED
9. Valve and Accessory System I: NOT USED
10. Valve and Accessory System J: NOT USED
11. Valve and Accessory System K: NOT USED

E. Miscellaneous Valves and Accessories:

1. Hose Valves:
 - a. Indoor: Acorn Flow-Cloz No. 8120; Chicago 387 p.c.; or equal.
 - b. Outdoor (Non-freezing type): J.R. Smith 5913; Zurn Z-1385; or equal.
 - c. Hose Racks: Suitable for 50 feet of 3/4-inch hose. W.D. Allen; Elkhart; or equal.
2. Link-Type Seals: Link-type seals shall be interlocking synthetic rubber links connected by stainless steel, zinc dichromate protected steel bolts and nuts to form a continuous belt. Tightening of the bolts shall expand the rubber to form a watertight seal of the annular space between a pipe and the hole or sleeve in the wall.
3. Pipe Service Saddles: Service saddles shall be provided and installed where shown on the Drawings. Service saddles for PVC pipe shall be the broad band strap or type with wrap around rubber gasket and be suitable for use in service up to 150 psi working pressure and 150°F. Body shall be bronze or stainless steel with 3/4-inch NPT tap. Service saddle shall be Rockwell 381; equivalent Baker; or equal.
4. Valve Boxes for Buried Valves: Adjustable, cast iron, screw-type, installed with top set at finished grade. All valve boxes and covers shall be suitable for H20 AASHTO wheel load. Clow Figure F-2454 with Figure F-2476 extension; equivalent products by Mueller; or equal.
5. Concrete Vaults and Valve Boxes: Precast reinforced concrete, of the size and orientation shown on the Drawings. Unless otherwise shown or noted, all vaults, boxes and their covers shall be designed for H20 AASHTO wheel loads. Provide Christy, Brooks, or equal.
6. Emergency Shower and Eyewash Units:
 - a. General: Units shall be heavy duty, designed for outdoor installation, wall mounting and come complete with emergency identification sign.
 - b. Shower: Western Drinking Fountain Company No. 863H, Haws Model 8122H, or equal.
 - c. Eyewash Bowl: Western Drinking Fountain Company Model 400B, Haws Model 7460B or equal.

2.6 THERMAL INSULATION FOR PLUMBING AND PIPING

A. General:

1. Delivery: Deliver insulation materials to the job in original packages with manufacturer's "R" values clearly shown. Provide certification of compliance.
2. Warning: The Contractor is warned that working with fiberglass or rock wool materials may constitute a serious health hazard. The Contractor shall take all necessary precautions to ensure the safety of the workers.
3. Appearance: Provide an insulation system with first class

appearance.

4. Shields: Insulation protection shields are required per Paragraph 2.7C.

B. Insulation System C for Plant Water Piping Exposed in Exterior Locations:

1. Material: Insulation shall be nominal 3/8-inch wall thickness flexible closed celled foamed plastic. Insulation shall have a "K" factor of not more than 0.30 at 70°F. Insulation shall have a usage range from -30°F to 220°F. Insulation shall be Armstrong Armaflex 22, Johns-Manville Aerotube, or equal.
2. Application: Seal all slit and butt joints with adhesive supplied by manufacturer. Fittings shall be covered with mitered insulation according to manufacturer's recommended procedures and sealed with adhesive. Insulation shall have first class appearance.
3. Finish: Finish all exposed insulation with two coats of manufacturer supplied finish in a color selected by the Contracting Officer.

C. Insulation System D: This system shall apply to all engine exhaust piping, engine-generator muffler, emission control devices, and heat recovery unit.

1. Material: Insulation shall be a pre-molded hydrous calcium silicate having an aluminum jacket (factory applied). Fittings shall be insulated using mitered sections of pre-molded insulation and covered with an aluminum jacket to match the straight pipeline. Insulation shall be Johns-Manville "Thermo-12" with "Metal-On" jacket; Owens-Corning Fiberglas "Kalo-10" with metal jacketing; or equal.
2. Engine exhaust flexible coupling shall incorporate a soft, flexible jacket in lieu of an aluminum jacket to allow flexibility.

2.7 PIPE SUPPORTS

A. Manufacture and Design: Pipe supports shall to the maximum extent possible be standard factory fabricated units conforming to the typical supports and braces shown in the Drawings and as specified below. Where required support cannot be provided by standard factory fabricated units, and is not detailed on the Drawings, the Contractor shall provide special pipe supports. Supports shall be manufactured or special fabrications or combination as shown on the Drawings or specified. Special fabrications shall be in conformance with Section 05500. Provide 3/4-inch chamfer on corners of all support elements and file or grind smooth. Supports designated to allow axial pipe movement shall have smooth and even contact surfaces.

B. Materials: All support systems shall be galvanized steel except that those that are submerged or that are located within a tank, channel, or other structure designed to hold water or tank wall top, or otherwise called out on the Drawings, shall be Type 304 stainless steel. Trays for continuous support of plastic pipe or tubing shall be made of 20-gauge galvanized steel.

C. Insulation Protection Shields: Provide insulation protection shields at all pipe supports for insulated piping.

- D. Provide plastic caps with rounded corners on all exposed ends of channels.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

A. General Handling and Placing:

1. Exercise great care to prevent injury to or scoring of the pipe lining and coating, as applicable, during handling, transportation or storage. Handle fusion epoxy coated pipe in accordance with AWWA C213. Do not store pipe on rough ground and do not roll the pipe on the coating. Any damaged pipe sections, specials, or fittings shall be repaired or replaced at the expense of the Contractor as satisfactory to the Contracting Officer.
2. Carefully inspect each pipe fitting, valve and accessory before installation. Inspect the interior and exterior protective coatings and patch all damaged areas in the field or replace to the satisfaction of the Contracting Officer.
3. Place or erect all piping to accurate line and grade and backfill, support, hang, or brace against movement as specified or shown on the Drawings, or as required for proper installation. Remove all dirt and foreign matter from the pipe interior prior to installation and thoroughly clean all joints before joining.
4. Use reducing fittings where any change in pipe size occurs. Do not use bushings unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.
5. Cast all metallic pipes and sleeves into new concrete walls without blockout. Maintain at least 1/2-inch clearance between reinforcing steel and metal pipe in penetrations.
6. Cover polyvinyl chloride (PVC) pipe stored outside for more than two months with canvas or other opaque material. Provide for air circulation under the covering.

B. Installation Specifics:

1. Type A-3 Pipe:
 - a. Unless specifically otherwise shown, lay each length of pipe on a firm bed with a true bearing for its entire length between bell holes. Excavate holes of only sufficient size to accommodate the bell shall be excavated at each joint location. Adjustment to line and grade shall be made by scraping away, filling in, and tamping the backfill material to provide true grade to fit the barrel of the pipe. No wedging or blocking up of the pipe will be permitted.
 - b. Clean both bell and spigot before the joint is made and take care that nothing but the joint material and lubricant enters the joint. Lubricate pipe spigot, bell, and gasket in accordance with the manufacturer's recommendations. Properly place gasket into the groove on the spigot before joining. Pipe shall be jointed together to provide the proper space between abutting ends of pipe. Joints may be pulled to compensate for slight grade and

alignment changes. In no case shall the joint pull exceed 1/2-inch or one-half the manufacturer's recommended value, whichever is smaller.

c. After a joint is assembled, insert a thin metal feeler gauge between bell and spigot and check the position of the rubber gasket around the complete circumference of the pipe. If gasket is not in proper position, the pipe shall be withdrawn, the gasket checked to see that it is not cut or damaged, the pipe relaid, and the gasket position again checked.

d. Thoroughly clean the groove and tongue ends of the pipes to be joined with a wet brush. Place a layer of soft mortar on the lower half of the groove and the upper half of the tongue. Insert the tongue end into the groove end until the mortar is squeezed out on the interior and exterior surfaces. Brush the interior surface of the pipe at the joint smooth.

e. Immediately backfill the joint or cure the joint with moist burlap for 48 hours.

f. After making the joint, rigidly secure the pipe in place by backfilling to the top of the pipe on each side of the pipe at the center section, but not as to fill the bell hole nor interfere with the next jointing operation, and compacted in such a manner as not to disturb the pipe.

g. When pipe laying is not in progress, keep the forward end of the pipe effectively closed with a temporary plug.

2. Type M-2 Pipe:

a. Field welding of joints shall be in accordance with AWWA C206, except that the weld testing shall be as modified by these Specifications.

b. Following satisfactory testing of the weld, the interior of all joints shall be cement mortar lined and the exterior of the joints of Type M-2 Pipe shall be cement mortar lined in accordance with Appendix A of AWWA C205, except that pipe 24 inches and less shall be finished using the handhole. Prior to coating the exterior, tack weld one layer of wire mesh to the pipe.

c. Steel edges not encased in concrete shall receive 16 mils of coal tar epoxy.

3. Type N-1 Pipe:

a. Install buried pipe in accordance with AWWA C600.

b. Support and brace encased pipe to support the pipe and to prevent movement during testing and placement of the concrete encasement. The braces and supports shall be erected of materials and by methods which will prevent any future contact of the pipe with the environment surrounding the encasement.

4. Type N-2 Pipe:

a. Flanged Joints: Flanged joints shall be made up tight with care being taken to avoid undue strain in the flanges, fittings, and other accessories. Bolt holes shall be aligned for each flanged joint. Bolts shall be full size for bolt holes; use of undersize bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Adjoining flange faces shall not be out of parallel to such a degree that the flanged joint cannot be made watertight without overstraining the flange. Any flanged pipe or fitting whose dimensions do not allow the making of a proper flanged joint as specified herein shall be

replaced by one of the proper dimensions. Clean flanges before jointing is started. Buried flanged pipe connections shall be made with the smallest practical "bell" hole. After the joint is completed take special care to completely fill the "bell" hole under and around the pipe with compacted backfill.

b. Mechanical Grooved Couplings: Install in accordance with the manufacturer's instructions.

5. Type T-1 Pipe:

a. Bends shall be made in a manner that does not crimp or flatten pipe.

b. Dielectric unions shall be installed at connections with ferrous piping.

c. Pipe shall have joints squarely cut clean. Soldered joints shall be properly fluxed and heated before solder is placed in the joint. Joints must be driven up tight before solder is added. Compression and flared joints shall be made up in accordance with the fitting manufacturer's installation instructions. Brazing shall be in accordance with ANSI B31.1.

6. Type V-1 Pipe:

a. Place PVC pipe within the installation areas at least 24 hours prior to installation to permit temperature equalization.

b. Cut pipe ends squarely, ream and deburr inside and out.

c. Solvent Weld Joints: Clean pipe ends and sockets and join in strict conformance with the pipe manufacturer's instructions. Make joints in accordance with ASTM D2855. Handle solvent cements and primers in accordance with ASTM F402.

d. Containment fittings for chemical and chemical solution lines shall be installed and tested in accordance with manufacturers' instructions. Install containment pipe with position clips at 3-foot centers and at fittings during installation of carrier pipe. Do not make joints until after successful leak tests of carrier pipes.

e. Threaded connections shall use a short nipple, threaded at one end, socket at the other. Provide thread sealant in accordance with the pipe manufacturer's recommendations. Take care not to overtighten the connection.

7. Type Y-1 Pipe: Threaded joints shall have connections made metal to metal tight. Remove all burrs from ends of pipe, and clean threads of all oil and chips. Coat male threads with joint lubricant. Properly tape wrap joints of plastic coated pipe.

3.2 COUPLING INSTALLATION

A. Flexible Couplings and Flange Coupling Adaptors: Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Wipe gaskets clean before they are installed. If necessary, flexible couplings and flanged coupling adapter gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Tighten bolts progressively, drawing up bolt on opposite sides a little at a time until all bolts have a uniform tightness. Workers tightening bolts shall be equipped with torque-limiting wrenches or other favorably reviewed type.

B. Tie Rods: Except where double nutting is called for on the Drawings, install the nuts snug. Tighten the nuts gradually and equally at opposite sides of the pipe until snug to prevent misalignment and to ensure that all rods carry equal loads.

C. Flexible Expansion Joints: Install in accordance with manufacturer's instructions. Unless otherwise shown on the Drawings install with $\frac{1}{2}$ the maximum expansion.

3.3 INSTALLATION OF VALVES AND ACCESSORIES

A. Install valves and accessories such that all parts are easily accessible for maintenance and operation.

B. Where valve handwheels are shown on the Drawings, valve orientation shall be as shown. Where valve handwheels are not shown, orient valves to permit easy access to the handwheels or handles and to avoid interferences.

C. Install pressure gauges and thermometers in a position to permit reading them from a point approximately 5 feet above floor level.

D. Rigidly support pressure switches and connect them to piping and equipment using a suitable flexible linkage that will not permit transmission of vibrations from the piping or equipment to the pressure switches.

E. Install a union adjacent to each screwed end valve and accessory with additional unions as necessary to facilitate removal.

F. Install a valve below each pressure gauge or protective devices unless otherwise specified.

G. Wherever a solenoid valve is shown on the Drawings or required by the equipment supplied, it shall be electrified as required at no additional cost to the Government. Minimum conduit size shall be 3/4-inch with flexible connector at valve, and minimum wire size shall be 2-#12.

H. Connections between ferrous and non-ferrous piping, valves, accessories or pipe supports shall be made using a dielectric coupling, union, or flange.

I. All insulated piping passing through walls or slabs shall be sleeved and insulation shall run continuously through the sleeves and shall allow for 1/8-inch annular clearance between outside of insulation and sleeve wall.

J. Install a suitable chrome plated escutcheon on pipes passing through slabs or walls in finished areas.

K. Use reducing fittings where any change in pipe size occurs. Do not use bushings unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines. Each piece of pipe and each fitting shall be carefully inspected to see that there is no defective workmanship on pipe, or obstructions in pipes

and fittings. Anchor piping subject to expansion or contraction in a manner permitting strains to be evenly distributed. Sleeves for branches through walls from adjacent mains shall be of sufficient size to allow for free side motion of covered pipe in sleeves.

L. Install butterfly valves in accordance with AWWA C504, Appendix B, Sections B.2 through B.5, inclusive.

3.4 INSTALLATION OF PIPE SUPPORTS

A. General:

1. Install and adjust supports for each pipeline such that the pipeline is true to the indicated line and grade.
2. Locate anchors and braces for any single support on a continuous structure; that is, not on two sides of a structural expansion joint.
3. Tighten clamps to develop full friction along the pipeline except where loose fitting clamps are called for.

B. Electrolytic Protection: Pipe supports serving copper pipe or tubing shall be dielectrically insulated from the pipe by dielectric sleeves or plastic pipe wrap at the point of contact.

3.5 PIPE AND VALVE IDENTIFICATION

A. General: Identify all exposed piping in this project by painting, banding, system name labels, and direction arrows. The color and banding shall be as selected by the Contracting Officer. Identify all buried valves with tags as specified below.

B. Exposed Pipe Identification: Before painting, banding and labeling, pipes shall be identified by the Contractor with temporary wired-on cardboard tags showing the proposed marking for review by the Contracting Officer.

C. Piping: Paint all exposed pipes with the appropriate paint system as specified in Section 09960.

D. Valves: Provide each buried valve with a valve tag identifying the pipeline contents, and either its valve number, or the area or item served by the valve for valves without a valve number. Contents shall be as designated in the Piping Schedule.

3.6 CLEANING

A. Prior to testing, thoroughly clean the inside of each completed piping system of all dirt, loose scale, sand and other foreign material. Cleaning shall be by sweeping, flushing with water or blowing with compressed air or oil-free nitrogen gas, as appropriate for the size and type of pipe. Flushing shall achieve a velocity of at least 3 feet per second. The Contractor shall install temporary strainers, temporarily disconnect equipment or take other appropriate measures to protect equipment while cleaning piping.

3.7 FIELD TESTING

A. General: Perform leakage tests on all pipe installed in this project. Furnish all equipment, material, personnel and supplies to perform the tests and make all taps and other necessary temporary connections. The test pressure, allowable leakage and test medium shall be as specified in the following paragraphs. Test pressure shall be measured at the highest point on the line unless specifically noted otherwise. Leakage tests shall be performed on all piping at a time agreed upon and in the presence of the Contracting Officer.

B. Buried Piping: The leakage test for buried piping shall be made after all pipe is installed and backfilled and subgrade has been compacted. However, the Contractor may conduct preliminary tests prior to backfill. If the Contractor elects to conduct preliminary tests, provide any necessary temporary thrust restraint.

C. Exposed Piping: All supports, anchors and blocks shall be installed prior to the leakage test. No temporary supports or blocking shall be installed for final test.

D. Encased Piping: The leakage test for encased piping shall be made after all pipe is installed and encased, and before any structures are constructed above it. However, the Contractor may conduct preliminary tests prior to encasement. If the Contractor elects to conduct preliminary tests, provide any necessary temporary thrust restraint.

E. Accessories: It shall be the responsibility of the Contractor to block off or remove equipment, valves, gauges, etc., which are not designed to withstand the full test pressure.

F. Testing Apparatus: Provide pipe taps, nozzles and connections as necessary in piping to permit testing including valves to isolate the new system, addition of test media, and draining lines and disposal of water, as is necessary. These openings shall be plugged in a manner favorably reviewed by the Contracting Officer after use. Provide all required temporary bulkheads.

G. Pneumatic Testing: Piping tested by air or another gas shall show no reduction of pressure during the test period after corrections have been made for changes in temperature in conformance with the following relationship:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

Where T1 and T2 are the absolute temperatures of the gas in the pipe and P1 and P2 are the absolute pressures. The subscript "1" denotes the starting conditions and the subscript "2" denotes the final conditions.

H. Precautions for Pneumatic Testing: Where air or another gas is called for as the test medium, the Contractor shall take special precautions to protect personnel. During the initial pressurization of a pipeline to the specified test pressure, personnel shall be protected by suitable

barricades or shall remove themselves to locations where portions of the concrete structure itself are between them and the pipeline under test.

I. Correction of Defects: If leakage exceeds the allowable, the installation shall be repaired or replaced and leakage tests shall be repeated as necessary until conformance to the leakage test requirements specified herein have been fulfilled. All visible leaks shall be repaired even if the pipeline passes the allowable leakage test.

J. Drying: Gas lines with water shall be drained and blown dry.

K. Reports: The Contractor shall keep records of each piping test, including:

1. Description and identification of piping tested.
2. Test pressure.
3. Date of test.
4. Witnessing by Contractor and Contracting Officer.
5. Test evaluation.
6. Remarks, to include such items as:
 - a. Leaks (type, location).
 - b. Repairs made on leaks.
7. Test reports shall be submitted to the Contracting Officer.

L. Venting: Where not shown on the Drawings, the Contractor may install valved "tees" at high points on piping to permit venting of air. Valves shall be capped after testing is completed.

M. Testing Specifics:

Piping Test Schedule

Legend	System	Test Pressure	Test Medium	Allowable Leakage
WW, AW FW, SW, PW	Well Water Aerated Water, Filtered Water, Surface Wash, Plant Water	150 psi	Water	None
BW, RW	Backwash Rinse Water	150 psi	Water	None
CLS	Chlorine Solution	150 psi	Water	None
FLS	Fluoride Solution	150 psi	Water	None
--	Spare	150 psi	Water	None
SS	Sewer, Storm Drain	15 psi	Air or Water	None

3.8 DISINFECTION OF POTABLE WATER SYSTEMS

A. See Section 11003.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15400

PLUMBING

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DESCRIPTION
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 GENERAL
- 2.2 PLUMBING FIXTURES AND ACCESSORIES
- 2.3 PIPING, FITTINGS, VALVES, PIPE INSULATION AND PIPING ACCESSORIES
- 2.4 PIPE SUPPORTS

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 DISINFECTION OF POTABLE WATER SYSTEMS
- 3.3 TEST AND INSPECTION
- 3.4 PIPE AND VALVE IDENTIFICATION
- 3.5 CLEANING

-- End of Section Table of Contents --

SECTION 15400

PLUMBING
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z358.1	(1990) Emergency Eyewash and Shower Equipment
ANSI Z21.10.1	Storage Water Heaters
ANSI A117.1	Specifications for Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped

UNDERWRITERS LABORATORIES INC. STANDARDS

U.L. 174	Standards for Safety
----------	----------------------

CALIFORNIA BUILDING STANDARDS CODE

Title 24, Part 5	California Code of Regulations (CCR), California Plumbing Code
------------------	---

1.2 DESCRIPTION

A. Section Includes: Furnish all labor, materials, equipment, services and incidentals required to install a complete, operable and tested, plumbing system as specified herein and as shown on the Drawings. All materials and equipment shall be new and of the best quality. Work shall include, but not necessarily be limited to:

1. Sanitary, waste, drain and vent systems, within structures and extending to 5 feet outside of structures.
2. Hot and cold (domestic) water systems.
3. Roof drainage, floor drainage and equipment drainage.
4. Emergency showers and eyewashes.
5. Plumbing fixtures and trim.
6. Laboratory piping.
7. Condensate drains and traps for air conditioning equipment.
8. Testing.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Plumbing System Brochures; FIO.

Manufacturer's brochures for favorable review of the plumbing system. The submittals shall contain sufficient data to show that the equipment conforms to the Specification requirements, including: sizes, materials of construction, and pertinent manufacturer's data.

SD-19 Operation and Maintenance Manuals

Manuals; FIO.

Manufacturer's installation drawings, operation and maintenance manuals, bulletins, and spare parts lists.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide equipment and materials conforming to the standards and manufacturers' serial numbers shown, or equal.

2.2 PLUMBING FIXTURES AND ACCESSORIES

A. Water Closets: White vitreous china, flush-valve operated (1.6 gallons per flush), elongated bowl, syphon jet, Church 9500 open-front seat and meet or exceed ANSI A112.19.2. Top of seat on ADA water closets: Between 17 and 19 inches above finished floor. Provide water hammer arrestor on supply piping.

1. Water Closet: ADA water closet shall be floor-mounted, American Standard "Madera 17" EL" 3043.104; Kohler "Highcliff" K-4368; or equal. Flush Valve shall be Sloan "Royal" model 111.

B. Lavatories: White vitreous china, complete with faucet-drain assemblies, traps, and supplies with angle stops. Angle stops and supplies shall be Chicago Faucet Co.; T&S Brass; or equal. Lavatory "P" traps, hot water piping and valves shall be insulated with replaceable contour molded fire-resistive foam similar to "Lav-Guard" by Truebro; "Skalgard" by TCI Products; or equal. Lavatories shall meet ADA Specifications. Faucets shall be lead free.

1. Lavatory: Kohler Greenwich K-2030; American Standard Lucerne 0356.015; or equal. Faucet holes on 8-inch centers. Concealed arm carrier support.
2. Faucet: Kohler Triton K-7471 with K-16102-5 wrist blade handles; American Standard Heritage 4801.000.002 with Amarilis Series 372H wrist blade handles; or equal. Two-handle, widespread faucet with

conventional spout. 2.5 gpm flow restrictor. Chrome finish.

C. Laboratory Sink:

1. General: Provide laboratory sinks of corrosion-resistant one-piece thermoplastic mold double-bowl, with bottom sloped to drain. Drain outlets shall be 1-½ inch size. Overall size is 33 inch long x 22 inch wide x 10 inch deep.
2. Sink Faucets and Drains:
 - a. Sink faucet assemblies: Chicago Faucet Company model 947 with 4-inch wrist blade handles; T&S Brass; or equal.
 - b. Sink drain assemblies: Lab-Line/Enfield W301 outlet with W131 adapter, W1021 trap and W321 overflow; R&G Sloane Manufacturing Company 7841 A outlet with 7218 adapter, 7225 P-trap and 7842 overflow; or equal.

D. Emergency Eyewash and Shower Combination Units: Units shall be base mounted with galvanized steel stanchion piping as standard. Piping shall be supplied with corrosion-resistant coating. Shower head shall be of sunlight-resistant plastic. Eyewash shall be provided with stainless steel bowl. Shower flow shall be activated by pull rod. Eyewash flow shall be activated by push handle. Shower flow shall be regulated to 30 gpm, maximum.

1. Outdoor Installation (includes freeze protection bleed valve): Haws, model 8330.158.CRP; Speakman, model SE-695-FRV; or equal.

E. Floor Drains and Traps: Cast iron drains having inside caulk or push-on compression type neoprene gasket joints.

1. FD-1 (For Industrial Areas): Zurn Z-520; Wade 1340; or equal.
2. FD-7 (For Finished Floors): Zurn Z-415-B, Wade W-1100-AX; or equal, complete with heelproof strainer.
3. Running Traps: Provide running traps with trap primer connection outlet in locations noted on Drawings. Running traps shall be designed to cast iron soil pipe specifications with bell and spigot connections.

F. Trap Primers: Precision Plumbing Products Trap Primer Valves models "P-1" or equal of alternate manufacture. Unit shall be listed by IAPMO and approved under ASSE standard 1018. Where noted on the Drawings, provide trap primer distribution unit to supply multiple plumbing traps. Precision Products type DU-3, or equal.

G. Floor Cleanouts: Zurn Z-1400; Wade 7000; or equal. Provide scoriated top.

H. Water Heaters:

1. Water heater:
 - a. Water heater shall be factory assembled, compact, packaged electric storage type, nominal 30-gallon tank, insulated, glass lined, enclosed controls, UL approved.
 - b. Element shall be 6,000 watts and operate on 208-volt, 1-phase power to heat not less than 0.5 gpm of 60°F cold water to 100°F.
 - c. Maximum working pressure of not to exceed 150 psi.
 - d. Shall include automatic control, disconnecting means, thermal insulation, contactor and overheat cut-outs.

- e. Rheem, State; or equal.
- 2. Accessories:
 - a. Water heater shall include a combination temperature and pressure relief valve. Valve shall be Watts; or equal. Install in accordance with manufacturer's recommendations.

I. Water hammer arrestors shall be Wade "Shokstop" no. W-10; Zurn no. Z-1700; or equal.

J. Showers: Barrier-Free shower shall be Kohler Freewill K-12492 with low lead brass components; or equal. Provide pressure balanced anti-scald mixing valve for shower.

2.3 PIPING, FITTINGS, VALVES, PIPE INSULATION AND PIPING ACCESSORIES

A. Materials:

- 1. Pipe:
 - a. Type N-3:
 - 1) Pipe and Fittings: Bell and spigot service weight cast iron soil pipe or no hub cast iron soil pipe. (No hub pipe shall not be used in exposed locations.)
 - (a) Bell and Spigot: ASTM A74.
 - (b) No Hub: Cast Iron Soil Pipe Institute Standard No. 301.
 - 2) Bell and Spigot Gaskets: Sewage and oil resistant, ASTM C564.
 - 3) No Hub Couplings: Cast Iron Soil Pipe Institute Standard No. 301.
 - b. Type Q-2 Pipe:
 - 1) Pipe and Fittings: Acrylonitrile-Butadiene-Styrene (ABS) sewer pipe and fittings, ASTM D2751
 - 2) Standard Dimension Ratio: 23.5
 - 3) Joints: Solvent cement
 - c. Type T-1 Pipe:
 - 1) Pipe: Copper, ASTM B88.
 - (a) Buried: Type K (soft drawn).
 - (b) Exposed: Type L (hard drawn).
 - 2) Joints:
 - (a) Buried: Soldered or flared.
 - (b) Exposed: Soldered.
 - 3) Solder: ASTM B32, alloy grade E or HB. Solder and flux shall contain less than 0.2% lead.
 - 4) Fittings:
 - (a) Soldered: Wrought copper, ANSI B16.22; or cast bronze, ANSI B16.18.
 - (b) Flared: AWWA C800 and ANSI B16.26
- 2. Valve and Accessories - Cold Water - Potable/Non-potable:
 - a. Gate Valves through Size 2-inch:
 - 1) Rating: 200 psi WOG.
 - 2) Type: Rising stem, screw in bonnet, solid wedge disc, handwheel operated.
 - 3) Connections: Threaded.
 - 4) Materials: All bronze.
 - 5) Manufacturers: Jenkins Figure 47-U; Crane No. 428; or

- equal.
- b. Globe Valves through size 3-inch:
 - 1) Rating: 300 psi WOG.
 - 2) Type: Union bonnet, composition or teflon disc, handwheel operated, straight or angle pattern.
 - 3) Connections: Threaded.
 - 4) Materials: All bronze.
 - 5) Manufacturer: Jenkins 106A; Crane 7TF; or equal.
 - c. Ball Valves through size 4-inch in metal piping:
 - 1) Rating: 400 psi WOG.
 - 2) Type of operator: Lever.
 - 3) Connections: Threaded.
 - 4) Materials: Bronze body and ball, teflon seats.
 - 5) Manufacturers: Jenkins 32A; Crane 2330TF; or equal.
 - d. Swing Check Valves through size 2-inch:
 - 1) Rating: 300 psi WOG.
 - 2) Type: Swing, composition disc.
 - 3) Connections: Threaded.
 - 4) Materials: All bronze.
 - 5) Manufacturers: Jenkins 352; Crane 141; or equal.
 - e. Strainers:
 - 1) Rating: 125 psi.
 - 2) Type: Y-type basket strainers
 - 3) Connections: Threaded or Flanged.
 - 4) Materials: bronze body.
 - 5) Screen: bronze, no. 40 mesh
 - 6) Manufacturers: Bailey 100A; Hoffman Series 400, 450; or equal.
 - 7) Installation: Each to be complete with ball valve on blowoff and piping to drain.
 - f. Pressure Reducing Valves:
 - 1) For Water:
 - (a) Self-Contained: Valves Watts No. U5B for low flows or 223S for flows to 170 gpm.
 - (b) Provide strainers with stainless steel screens.
 - (c) Sizes, capacities and pressures shall be as noted on the Drawings.
 - g. Backflow Preventer:
 - 1) Reduced pressure type with shutoff valves and test cocks, size as shown on the Drawings. Headloss shall not exceed 10 psi at maximum flow.
 - (a) 2-inch and smaller: ClaVal Model RP6L; Watts Series 909; or equal.
 - (b) 2½-inch and larger: ClaVal Model RP7L; Watts Series 909; or equal.
3. Valve and Accessory: Hot potable water at pressures to 150 psi and temperatures to 150°F utilizing copper piping.
- a. Globe Valves through 2-1/2-inch:
 - 1) Rating: 200 psi water.
 - 2) Type: Renewable disc, globe or angle.
 - 3) Connections: Solder ends for copper pipe.
 - 4) Materials: All bronze.
 - 5) Manufacturers: Jenkins Figure 1200 or Figure 1202; Crane No. 1310; or equal.

- b. Check Valves through 2-1/2-inch:
 - 1) Rating: 200 psi water.
 - 2) Type: Regrinding swing check.
 - 3) Connections: Solder ends for copper pipe.
 - 4) Materials: Bronze with bronze or brass disc.
 - 5) Manufacturers: Jenkins Figure 4093; Crane No. 1342; or equal.
- c. Pressure Relief Valves:
 - 1) Rating: 150 psi for valves 2-inch and smaller.
 - 2) Type: Adjustable spring loaded with Y-strainer.
 - 3) Connections: Threaded.
 - 4) Materials: Bronze body.
 - 5) Manufacturers: Consolidated 2478; Farris 1400S; or equal.
- d. Strainers shall be bronze, threaded end with 1/32-inch perforated screen, Hayward Model 80; or equal. Provide ball valve on blowoff and pipe to drain.

2.4 PIPE SUPPORTS

- A. Manufacture and Design: Pipe supports shall to the maximum extent possible be standard factory fabricated units conforming to the typical supports and braces shown in the Drawings and as specified below. Where required support cannot be provided by standard factory fabricated units, and is not detailed on the Drawings, the Contractor shall provide special pipe supports. Supports shall be manufactured or special fabrications or combination as shown on the Drawings or specified.
- B. Materials: All support systems shall be galvanized steel.
- C. Provide plastic caps with rounded corners on all exposed ends of channels.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install escutcheons secured to pipe with set-screw where pipes or tubing pass through exposed walls or ceilings.
- B. Provide all fixtures with traps and vents unless otherwise indicated on the Drawings.
- C. Unless indicated otherwise, all soil, waste and drain piping shall be sloped not less than 1/4-inch per foot downward in the direction of flow.
- D. Provide unions or flanges where equipment is installed in piping. Also provide dielectric unions or couplings at points of connection of ferrous to non-ferrous metal piping.
- E. Provide a shut-off stop valve in the branch of every water pipe service upstream of every fixture or outlet.
- F. Provide identification nameplates for each item of mechanical equipment.

- G. Furnish and install all supports, bracing and blocking required for the proper installation of the plumbing work specified herein.
- H. Water hammer arrestors shall be installed in water systems upstream of each solenoid valve and each quick closing valve.
- I. Vent flashing at roof, unless otherwise shown on the Architectural Drawings, shall be a 4 lb lead sheet extending from a 4-inch (minimum) skirt at roof line, up to the open end of vent. At the open end of vent, the lead sheet shall be turned down into the vent opening.
- J. Sinks, which are to be installed in countertops, shall be delivered to the countertop manufacturer so that openings can be coordinated. Sink shall then be shipped to the job site for final installation.
- K. Place or erect all piping to accurate line and grade and backfill, support, hang, or brace against movement as specified or shown on the Drawings, or as required for proper installation. Remove all dirt and foreign matter from the pipe interior prior to installation and thoroughly clean all joints before joining.
- L. Use reducing fittings where any change in pipe size occurs. Do not use bushings unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.
- M. Trenching, bedding, and backfill for buried piping shall be as shown on the Drawings and as specified in Section 02300.
- N. Where no pipe grade elevations are shown on the Drawings, install buried piping with at least 3 feet of cover to finished grade. Where piping crosses under buried electrical ducts, provide at least 4 feet 6 inches of cover. Provide 12 inches minimum separation between the buried pipes and ducts.
- O. Provide each pipe with a firm, uniform bearing for its full length in the trench except at field joints. Do not lay pipe in water or when trench conditions or weather are unsuitable for such work.
- P. Where piping leaves a structure or concrete encasement, provide a joint capable of angular deflection within 12 inches of the structure for pipes 12-inch and smaller or as shown on the Drawings for larger pipe sizes.
- Q. Snake buried PVC pressure pipe from side to side in the trench in long sweeps.
- R. Concrete Encasements: All piping and conduits installed under slabs or footings on earth or crushed rock shall be encased in concrete not less than 6-inch thickness on all sides and extending up to the bottom of the slab or footing, unless otherwise specifically noted on the Drawings. Encasement shall extend to within 6 inches of the first pipe joint beyond the slab or footing. This requirement for concrete encasement applies to all piping including tubing, plumbing, and drains. Provide concrete encasement whether or not the encasement is shown on the Drawings. Provide

encasement under slabs on earth or crushed rock even if the structure is supported on piles, caissons, or footings. Provide continuous concrete cradles where shown.

S. Do not pull bell and spigot, gasketed joints more than 50% of the maximum deflection permitted by the pipe manufacturer.

T. Provide valves wherever equipment drain connections are furnished and carry the discharge pipe to the nearest floor drain, drain trench or sump. Where no receptacle for drain exists, install drain piping to 1-inch above the floor. Drain piping and valve materials shall conform to the requirements of the system served.

U. Where pipes conveying liquids passes over motor control centers, electrical panels and other electrical devices, install a protective drainage tray below the piping.

3.2 DISINFECTION OF POTABLE WATER SYSTEMS

See Section 11003.

3.3 TEST AND INSPECTION

A. Test the systems and arrange for inspection by the Contracting Officer.

B. Water piping shall be hydraulically tested at not less than working pressure psig and demonstrated to be leak-free for a one-hour test period.

C. Waste, drain and vent piping shall be tested in conformance with the Uniform Plumbing Code with local amendments. Storm drain (rainwater) piping shall be tested similar to waste, drain and vent piping.

3.4 PIPE AND VALVE IDENTIFICATION

A. General: Identify all exposed piping in this project by painting, banding, system name labels, and direction arrows. The color and banding shall be as selected by the Contracting Officer. Identify all buried valves with tags as specified below.

B. Exposed Pipe Identification: Before painting, banding and labeling, the Contractor shall identify pipes with temporary wired-on cardboard tags showing the proposed marking for review by the Contracting Officer.

C. Piping: Paint all exposed pipes with the appropriate paint system as specified in Section 09960 and provide pipe markers per the schedule specified in Section 10401.

D. Valves: Provide each valve with a valve tag identifying the contents.

3.5 CLEANING

A. Prior to testing, thoroughly clean the inside of each completed piping system of all dirt, loose scale, sand and other foreign material. Cleaning shall be by sweeping, flushing with water or blowing with compressed air or

oil-free nitrogen gas, as appropriate for the size and type of pipe. Flushing shall achieve a velocity of at least 3 feet per second. The Contractor shall install temporary strainers, temporarily disconnect equipment or take other appropriate measures to protect equipment while cleaning piping.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

03/01

PART 1 GENERAL

- 1.1 SECTION INCLUDES
- 1.2 REFERENCES
- 1.3 DELIVERY AND STORAGE
- 1.4 SUBMITTALS

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCTS
- 2.2 ASBESTOS PROHIBITION
- 2.3 NAMEPLATES
- 2.4 EQUIPMENT GUARDS AND ACCESS
- 2.5 DUCTWORK COMPONENTS
 - 2.5.1 Metal Ductwork
 - 2.5.1.1 Transitions
 - 2.5.1.2 Metallic Flexible Duct
 - 2.5.1.3 General Service Duct Connectors
 - 2.5.2 Fibrous Glass Ductwork
 - 2.5.3 Ductwork Accessories
 - 2.5.3.1 Duct Access Doors
 - 2.5.3.2 Fire Dampers
 - 2.5.3.3 Splitters and Manual Balancing Dampers
 - 2.5.3.4 Air Deflectors and Branch Connections
 - 2.5.4 Duct Sleeves, Framed Prepared Openings, Closure Collars
 - 2.5.4.1 Duct Sleeves
 - 2.5.4.2 Framed Prepared Openings
 - 2.5.4.3 Closure Collars
 - 2.5.5 Diffusers, Registers, and Grilles
 - 2.5.5.1 Diffusers
 - 2.5.5.2 Registers and Grilles
 - 2.5.6 Louvers
 - 2.5.7 Bird Screens and Frames
- 2.6 AIR SYSTEMS EQUIPMENT
 - 2.6.1 Fans
 - 2.6.1.1 Roof Exhaust Fans:
 - 2.6.1.2 Centrifugal Type Power Roof Ventilators
 - 2.6.1.3 Ceiling Exhaust Fans
 - 2.6.1.4 Wind-Driven Rotary - Turbine Ventilators
 - 2.6.2 Air Filters
 - 2.6.2.1 Sectional Cleanable Filters

- 2.6.2.2 Replaceable Media Filters
- 2.6.2.3 Holding Frames
- 2.7 AIR HANDLING UNITS
 - 2.7.1 Factory-Fabricated Air Handling Units
 - 2.7.1.1 Casings
 - 2.7.1.2 Air Filters
 - 2.7.1.3 Fans
 - 2.7.1.4 Dampers
- 2.8 Air Conditioning Equipment
- 2.9 COMFORT HEATERS
 - 2.9.1 Wall-Mount (Electric) Convection Heater
 - 2.9.2 Package Terminal Heat Pump
- 2.10 FACTORY PAINTING

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Condensate Drain Lines
 - 3.1.2 Equipment and Installation
 - 3.1.3 Access Panels
 - 3.1.4 Flexible Connectors
 - 3.1.5 Sleeved and Framed Openings
 - 3.1.6 Metal Ductwork
 - 3.1.7 Dust Control
 - 3.1.8 Insulation
 - 3.1.9 Duct Test Holes
 - 3.1.10 Power Transmission Components Adjustment
- 3.2 FIELD PAINTING AND COLOR CODE MARKING
- 3.3 DUCTWORK LEAK TEST
- 3.4 CLEANING AND ADJUSTING
- 3.5 TESTING, ADJUSTING, AND BALANCING
- 3.6 PERFORMANCE TESTS
- 3.7 FIELD TRAINING

-- End of Section Table of Contents --

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM
03/01

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish all labor, materials, equipment, services and incidentals required to provide complete, integrated, and operating, Heating, Ventilating and Air Conditioning Systems for the buildings and structures in this project. Materials and equipment to be supplied shall be new, of the best quality as specified and as shown on the Drawings.
- B. Work Included in This Section:
1. Fans, air conditioning unit, air handling unit, comfort heaters, ductwork, registers, grilles, diffusers, ductwork insulation, ductwork support systems and temperature control systems.
- C. Appendix A is the Ventilation and Air Conditioning Schedule.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 350	(1986) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
ARI 410	(1991) Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 430	(1989) Central-Station Air-Handling Units
ARI 440	(1998) Room Fan-Coil and Unit Ventilator
ARI 445	(1987; R 1993) Room Air-Induction Units
ARI 880	(1998) Air Terminals
ARI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

AIR CONDITIONING CONTRACTORS OF AMERICA (ACCA)

ACCA Manual 4	(1990) Installation Techniques for
---------------	------------------------------------

Perimeter Heating & Cooling; 11th Edition

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 210 (1985) Laboratory Methods of Testing Fans for Rating

AMCA 300 (1996) Reverberant Room Method for Sound Testing of Fans

AMERICAN BEARING MANUFACTURERS ASSOCIATION (AFBMA)

AFBMA Std 9 (1990) Load Ratings and Fatigue Life for Ball Bearings

AFBMA Std 11 (1990) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S12.32 (1990; R 1996) Precision Methods for the Determination of Sound Power Levels of Discrete-Frequency and Narrow-Band Noise Sources in Reverberation Rooms

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47 (1990; R 1995) Ferritic Malleable Iron Castings

ASTM A 47M (1999) Ferritic Malleable Iron Castings (Metric)

ASTM A 53 (1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 106 (1999e1) Seamless Carbon Steel Pipe for High-Temperature Service

ASTM A 123/A 123M (1997ael) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 167 (1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 181/A 181M (1995b) Carbon Steel, Forgings for General-Purpose Piping

ASTM A 183 (1983; R 1998) Carbon Steel Track Bolts and Nuts

ASTM A 193/A 193M	(1999) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 234/A 234M	(1999) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A 536	(1999el) Ductile Iron Castings
ASTM A 733	(1999) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1997) Seamless Copper Tube
ASTM B 75M	(1997) Seamless Copper Tube (Metric)
ASTM B 88	(1996) Seamless Copper Water Tube
ASTM B 88M	(1996) Seamless Copper Water Tube (Metric)
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM B 650	(1995) Electrodeposited Engineering Chromium Coatings on Ferrous Substrates
ASTM B 813	(1993) Liquid and Paste Fluxes for Soldering Applications for Copper and Copper Alloy Tube
ASTM C 916	(1985; R 1996el) Adhesives for Duct Thermal Insulation
ASTM C 1071	(1998) Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)
ASTM D 520	(1984; R 1995el) Zinc Dust Pigment
ASTM D 1384	(1997a) Corrosion Test for Engine Coolants in Glassware
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 1785	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

ASTM D 2000	(1999) Rubber Products in Automotive Applications
ASTM D 2466	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM E 437	(1997) Industrial Wire Cloth and Screens (Square Opening Series)
ASTM F 872	(1984; R 1990) Filter Units, Air-Conditioning: Viscous-Impingement Type, Cleanable
ASTM F 1199	(1988; R 1998) Cast (All Temperature and Pressures) and Welded Pipe Line Strainers (150 psig and 150 degrees F Maximum)
ASTM F 1200	(1988; R 1998) Fabricated (Welded) Pipe Line Strainers (Above 150 psig and 150 degrees F)

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 15	(1994) Safety Code for Mechanical Refrigeration
ASHRAE 52.1	(1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
ASHRAE 68	(1986) Laboratory Method of Testing In-Duct Sound Power Measurement Procedures for Fans
ASHRAE 70	(1991) Method of Testing for Rating the Performance of Air Outlets and Inlets
ASHRAE 84	(1991) Method of Testing Air-to-Air Heat Exchangers

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.5	(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995; B16.22a1998) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B31.1	(1998) Power Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606	(1997) Grooved and Shouldered Joints
-----------	--------------------------------------

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1998) Structural Welding Code - Steel
----------	--

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1419	(Rev D) Filter Element, Air Conditioning (Viscous-Impingement and Dry Types, Replaceable)
--------------	---

EXPANSION JOINT MANUFACTURERS ASSOCIATION (EJMA)

EJMA Stds (1998; 7th Edition) EJMA Standards

INSTITUTE OF ENVIRONMENTAL SCIENCES (IES)

IES RP-CC-001.3 (1993) HEPA and ULPA Filters

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-25 (1998) Standard Marking System for Valves,
Fittings, Flanges and Unions

MSS SP-58 (1993) Pipe Hangers and Supports -
Materials, Design and Manufacture

MSS SP-69 (1996) Pipe Hangers and Supports -
Selection and Application

MSS SP-70 (1998) Cast Iron Gate Valves, Flanged and
Threaded Ends

MSS SP-71 (1997) Cast Iron Swing Check Valves,
Flanges and Threaded Ends

MSS SP-72 (1992) Ball Valves with Flanged or
Butt-Welding Ends for General Service

MSS SP-80 (1997) Bronze Gate, Globe, Angle and Check
Valves

MSS SP-85 (1994) Cast Iron Globe & Angle Valves,
Flanged and Threaded Ends

MSS SP-110 (1996) Ball Valves Threaded,
Socket-Welding, Solder Joint, Grooved and
Flared Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (1998) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NFPA 90A (1996) Installation of Air Conditioning
and Ventilating Systems

NFPA 96 (1998) Ventilation Control and Fire
Protection of Commercial Cooking Equipment

NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION (NAIMA)

NAIMA AH115 (1993) Fibrous Glass Duct Construction Standards

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVAC Duct Const Stds (1995; Addenda Nov 1997) HVAC Duct Construction Standards - Metal and Flexible

SMACNA Industry Practice (1975) Accepted Industry Practice for Industrial Duct Construction

SMACNA Install Fire Damp HVAC (1992) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems

SMACNA Leakage Test Mnl (1985) HVAC Air Duct Leakage Test Manual

UNDERWRITERS LABORATORIES (UL)

UL 94 (1996; Rev thru Jul 1998) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

UL 181 (1996; Rev Dec 1998) Factory-Made Air Ducts and Air Connectors

UL 214 (1997) Tests for Flame-Propagation of Fabrics and Films

UL 555 (1999) Fire Dampers

UL 586 (1996; Rev thru Aug 1999) High-Efficiency, Particulate, Air Filter Units

UL 705 (1994; Rev thru Feb 1999) Power Ventilators

UL 723 (1996; Rev thru Dec 1998) Test for Surface Burning Characteristics of Building Materials

UL 900 (1994; Rev thru Apr 1997) Test Performance of Air Filter Units

UL 1995 (1995; Rev thru Jul 1998) Heating and Cooling Equipment

UL Bld Mat Dir (1999) Building Materials Directory

UL Elec Const Dir (1998) Electrical Construction Equipment Directory

UL Fire Resist Dir (1999) Fire Resistance Directory (2 Vol.)

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Test Procedures; FIO.

Proposed test procedures for ductwork leak test and performance tests of systems, at least 2 weeks prior to the start of related testing.

System Diagrams; FIO.

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

SD-09 Reports

Test Reports; FIO.

Test reports for the ductwork leak test and performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

SD-13 Certificates

Affidavits; FIO.

Furnish affidavits from the manufacturers stating that the equipment has been properly installed and tested and each is ready for full time operation.

SD-19 Operation and Maintenance Manuals

Air Supply, Distribution, Ventilation, and Exhaust Manuals; FIO.

Four manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to

field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the Government for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour response to a service call on an emergency basis.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year experience shall include applications of components and equipment under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization.

2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

2.3 NAMEPLATES

Equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.4 EQUIPMENT GUARDS AND ACCESS

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded according to OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

2.5 DUCTWORK COMPONENTS

2.5.1 Metal Ductwork

Unless otherwise indicated, ductwork shall be galvanized steel of the gauge and fabrication that conforms to latest SMACNA HVAC Duct Construction Standards for 1-inch for w.g. Galvanized steel (LFQ) ductwork shall have not less than 1-1/4 ounces of galvanized coating (total for both sides) per square foot of sheet.

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA HVAC Duct Const Stds unless otherwise specified. Elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure Class 1/2, 1, and 2 inch w.g. ductwork shall meet the requirements of Seal Class C. Class 3 through 10 inch shall meet the requirements of Seal Class A. Sealant shall meet requirements of the UL Standards 181, 181A, or 181B. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA HVAC Duct Const Stds. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable. Outdoor air intake ducts and plenums shall be fabricated with watertight soldered or brazed joints and seams.

2.5.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

2.5.1.2 Metallic Flexible Duct

Metallic type duct shall be single-ply galvanized steel . Duct shall be of corrugated/interlocked, folded and knurled type seam construction, bendable without damage through 180 degrees with a throat radius equal to 1/2 duct diameter. Duct shall conform to UL 181 and shall be rated for positive or negative working pressure of 15 inches water gauge at 350 degrees F when duct is aluminum, and 650 degrees F when duct is galvanized steel or stainless steel.

2.5.1.3 General Service Duct Connectors

A flexible duct connector approximately 6 inches in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL Bld Mat Dir.

2.5.2 Fibrous Glass Ductwork

Fibrous glass ductwork may be provided in lieu of sheet metal ductwork except that fibrous glass ductwork will not be allowed in fan and equipment rooms, where subject to traffic or weather damage, for outside air intakes, for risers of more than two stories, in kitchen or fume exhaust ducts, to convey solids or corrosive gases, in concrete, for burial below grade, as casings or housings, or in systems used for life support systems. Fibrous glass ductwork, including all components, shall be fabricated according to NAIMA AH115 where the velocity and the static pressure are within its scope. Where the velocity or static pressure exceeds these limits, the ductwork manufacturer shall certify that the ductwork is intended for the velocities and pressures to be encountered, and that the proposed installation meets all performance criteria specified herein for metal ductwork. Fibrous glass ductwork shall have the thermal equivalent of the insulation specified for metal ductwork in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Field or factory fabricated fibrous glass ductwork shall conform to UL 181, Class 1. Duct wall penetrations, transverse joints and longitudinal seams shall be sealed as instructed by the manufacturer by one of the methods prescribed by NAIMA AH115, where applicable, except that pressure sensitive tape shall not be used as a sealant. All items necessary for a complete installation shall be provided as specified for sheet metal duct systems.

2.5.3 Ductwork Accessories

2.5.3.1 Duct Access Doors

Access doors shall be provided in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA HVAC Duct Const Stds. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 15 x 18 inches, unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable.

2.5.3.2 Fire Dampers

Fire dampers shall be 1-1/2 hour fire rated unless otherwise indicated. Fire dampers shall conform to the requirements of NFPA 90A and UL 555. The Contractor shall perform the fire damper test as outlined in NFPA 90A. A pressure relief damper shall be provided upstream of the fire damper. If the ductwork connected to the fire damper is to be insulated then this pressure relief damper shall be factory insulated. Fire dampers shall be automatic operating type and shall have a dynamic rating suitable for the maximum air velocity and pressure differential to which it will be subjected. Fire dampers shall be approved for the specific application, and shall be installed according to their listing. Fire dampers shall be equipped with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, will not impair the operation of the damper. Sleeves or frames shall be equipped with perimeter mounting angles attached on both sides of the wall or floor opening. Ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies shall be

constructed in conformance with UL Fire Resist Dir. Dampers shall not reduce the duct or the air transfer opening cross-sectional area. Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.5.3.3 Splitters and Manual Balancing Dampers

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges rounded. Splitters shall be operated by quadrant operators or 3/16 inch rod brought through the side of the duct with locking setscrew and bushing.

Two rods are required on splitters over 8 inches. Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 12 inches. Access doors or panels shall be provided for all concealed damper operators and locking setscrews. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.5.3.4 Air Deflectors and Branch Connections

Air deflectors shall be provided at duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections may be used in lieu of deflectors or extractors for branch connections. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and are described herein. Fixed air deflectors, also called turning vanes, shall be provided in 90 degree

elbows.

2.5.4 Duct Sleeves, Framed Prepared Openings, Closure Collars

2.5.4.1 Duct Sleeves

Duct sleeves shall be provided for round ducts 15 inches in diameter or less passing through floors, walls, ceilings, or roof, and installed during construction of the floor, wall, ceiling, or roof. Round ducts larger than 15 inches in diameter and square, rectangular, and oval ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 20 gauge galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53, Schedule 20 shall be used. Sleeve shall provide 1 inch clearance between the duct and the sleeve or 1 inch clearance between the insulation and the sleeve for insulated ducts.

2.5.4.2 Framed Prepared Openings

Openings shall have 1 inch clearance between the duct and the opening or 1 inch clearance between the insulation and the opening for insulated ducts.

2.5.4.3 Closure Collars

Collars shall be fabricated of galvanized sheet metal not less than 4 inches wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for round ducts 15 inches in diameter or less shall be fabricated from 20 gauge galvanized steel. Collars for round ducts larger than 15 inches and square, and rectangular ducts shall be fabricated from 18 gauge galvanized steel. Collars shall be installed with fasteners on maximum 6 inch centers, except that not less than 4 fasteners shall be used.

2.5.5 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified according to ASHRAE 70. Inlets and outlets shall be sound rated and certified according to ASHRAE 70. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Automatic operated

back draft dampers shall be installed in the ventilation duct when the duct penetrates a fire wall. Back draft dampers shall be located in the duct at the point of penetration of the fire wall. An air volume control damper shall be installed in the supply air duct servicing the operator/lab/restroom. The damper shall be located down stream of the supply air back draft damper as indicated on the drawing. Provide the volume damper with an accessible operator. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet above the floor, they shall be protected by a grille or screen according to NFPA 90A.

2.5.5.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. Air handling troffers or combination light and ceiling diffusers shall conform to the requirements of UL Elec Const Dir for the interchangeable use as cooled or heated air supply diffusers or return air units. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers.

2.5.5.2 Registers and Grilles

Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 6 inches below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 6 inches above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.5.6 Louvers

Louvers for installation in exterior walls which are associated with the air supply and distribution system shall be as specified in Section 07600 SHEET METALWORK, GENERAL.

2.5.7 Bird Screens and Frames

Bird screens shall conform to ASTM E 437, No. 2 mesh, aluminum stainless steel. Aluminum screens shall be rated "medium-light". Stainless steel screens shall be rated "light". Frames shall be removable type, or stainless steel or extruded aluminum.

2.6 AIR SYSTEMS EQUIPMENT

2.6.1 Fans

Fans shall be tested and rated according to AMCA 210. Fans may be connected to the motors either directly or indirectly with V-belt drive. V-belt drives shall be designed for not less than [150] [140] [120] percent of the connected driving capacity. Motor sheaves shall be variable pitch for 15 hp and below and fixed pitch as defined by ARI Guideline D. Variable pitch sheaves shall be selected to drive the fan at a speed which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave shall be provided when needed to achieve system air balance. Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts. Fans shall be provided with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan.

Fan and motor assemblies shall be provided with vibration-isolation supports or mountings as indicated. Vibration-isolation units shall be standard products with published loading ratings. Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated.

2.6.1.1 Roof Exhaust Fans:

Roof exhaust fans shall be factory fabricated assemblies, conventional and upblast as indicated on the Drawings, having fan, fan-motor, aluminum bird screen, roof curbs, and spun aluminum hood, complete with special features and accessories as indicated in the fan schedules. Where noted in these fan schedules, fan surfaces shall be coated with a corrosion-resistant, factory applied paint. Corrosion-resistant coatings shall be "Eisenheiss" or air-dried "Heresite" applied in strict conformance with the paint manufacturer's instructions. Fans shall bear the AMCA seal.

Fan capacities, static pressures, drive motor horsepower, air discharge flow directions, fan speeds, required electric services and other features shall be as listed in the fan schedules. Provide backdraft dampers where shown.

Manufacturers: Fans shall be the standard catalogued products of Carnes division of Wehr Corporation; Greenheck Fan Corporation; or equal, except as otherwise noted.

2.6.1.2 Centrifugal Type Power Roof Ventilators

Fans shall be V-belt driven with backward inclined, non-overloading wheel. Motor compartment housing shall be hinged or removable and weatherproof, constructed of heavy gauge aluminum. Fans shall be provided with birdscreen, disconnect switch, roof curb, and extended base. Motors

enclosure shall be dripproof type. Lubricated bearings shall be provided.

2.6.1.3 Ceiling Exhaust Fans

Suspended cabinet-type ceiling exhaust fans shall be centrifugal type, direct-driven. Fans shall have acoustically insulated housing. Integral backdraft damper shall be chatter-proof. The integral face grille shall be of egg-crate design or louver design. Fan motors shall be mounted on vibration isolators. Unit shall be provided with mounting flange for hanging unit from above. Fans shall be U.L. listed.

2.6.1.4 Wind-Driven Rotary - Turbine Ventilators

Wind-Driven rotary-turbine ventilators shall be non-powered roof mount units. Mount ventilators on the roof, away from any obstruction that block the wind. These units will spin freely with the slightest breeze. Ventilators bearing shall be sealed. They shall be constructed of zine-plated steel and minimum material thickness 24 gauge.

2.6.2 Air Filters

Air filters shall be listed according to requirements of UL 900, except high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method shall be as listed under the Label Service and shall meet the requirements of UL 586.

2.6.2.1 Sectional Cleanable Filters

Cleanable filters shall conform to ASTM F 872, and shall be 2 inches thick. Viscous adhesive shall be provided in 5 gallon containers in sufficient quantity for 12 cleaning operations and not less than one quart for each filter section. One washing and charging tank shall be provided for every 100 filter sections or fraction thereof. Each washing and charging unit shall consist of a tank and [single] [double] drain rack mounted on legs. Drain rack shall be provided with dividers and partitions to properly support the filters in the draining position. Initial pressure drop for clean filters shall not exceed the applicable values listed in ASTM F 872.

2.6.2.2 Replaceable Media Filters

Replaceable media filters shall be the dry-media type, of the size required to suit the application. Filtering media shall be not less than 2 inches thick fibrous glass media pad supported by a structural wire grid or woven wire mesh. Pad shall be enclosed in a holding frame of not less than 16 gauge galvanized steel, and equipped with quick-opening mechanism for changing filter media. The air flow capacity of the filter shall be based on net filter face velocity not exceeding 300 feet per minute, with initial resistance of 0.13 inches water gauge.

2.6.2.3 Holding Frames

Frames shall be fabricated from not lighter than 16 gauge sheet steel with rust-inhibitor coating. Each holding frame shall be equipped with suitable filter holding devices. Holding frame seats shall be gasketed. All joints

shall be airtight.

2.7 AIR HANDLING UNITS

2.7.1 Factory-Fabricated Air Handling Units

A. Units shall be single-zone draw-through type . Units shall include fans, coils, airtight insulated casing, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, vibration-isolators, and appurtenances required for specified operation. Vibration isolators shall be as indicated. Each air handling unit shall have physical dimensions suitable to fit space allotted to the unit and shall have the capacity indicated. Air handling unit shall have published ratings based on tests performed according to ARI 430.

B. Air handling units shall be factory fabricated assemblies in the horizontal arrangement. Units shall be complete with the following items:

1. Mixing boxes having electric motor operated control dampers for economizer cycle cooling.
2. 2-inch throwaway type fiberglass filters, located in a filter compartment having hinged and dogged access doors.
3. Aluminum fin/copper tube cooling coils having not more than 8 fins per inch.
4. Draw-through type backward included fans with motor drives having adjustable pitch sheaves.
5. Air handling units shall be complete with internal thermal insulation and vapor barrier.
6. Spring vibration isolators (seismically restrained type).

2.7.1.1 Casings

Casing sections shall be constructed of a minimum 18 gauge galvanized steel, or 18 gauge steel outer casing protected with a corrosion resistant paint finish according to paragraph FACTORY PAINTING. Casing shall be designed and constructed with an integral structural steel frame such that exterior panels are non-load bearing. Exterior panels shall be individually removable. Removal shall not affect the structural integrity of the unit. Casings shall be provided with inspection doors, access sections, and access doors as indicated. Inspection and access doors shall be insulated, fully gasketed, double-wall type, of a minimum 18 gauge outer and 20 gauge inner panels. Inspection doors shall be a minimum 12 inches wide by 12 inches high. Access Sections shall be according to this section.

Drain pan shall be double-bottom type constructed of 16 gauge galvanized steel , pitched to the drain connection. Drain pans shall be constructed water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Intermediate drain pans or condensate collection channels and downspouts shall be provided, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Each casing section handling conditioned air shall be insulated with not less than 1 inch thick, 1-1/2 pound density coated fibrous glass material having a thermal conductivity not greater than 0.23 Btu/hr-sf-F. Factory applied fibrous glass insulation shall conform to ASTM C 1071,

except that the minimum thickness and density requirements do not apply, and shall meet the requirements of NFPA 90A. Foam-type insulation is not acceptable. Foil-faced insulation shall not be an acceptable substitute for use on double-wall access doors and inspections doors. Duct liner material, coating, and adhesive shall conform to fire-hazard requirements specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Exposed insulation edges and joints where insulation panels are butted together shall be protected with a metal nosing strip or shall be coated to conform to meet erosion resistance requirements of ASTM C 1071. A latched and hinged inspection door, shall be provided in the fan and coil sections.

2.7.1.2 Air Filters

Air filters shall be as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.7.1.3 Fans

Fans shall be double-inlet, centrifugal type with each fan in a separate scroll. Fans and shafts shall be dynamically balanced prior to installation into air handling unit, then the entire fan assembly shall be statically and dynamically balanced at the factory after it has been installed in the air handling unit. Fans shall be mounted on steel shafts accurately ground and finished. Fan bearings shall be sealed against dust and dirt and shall be precision self-aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by AFBMA Std 9 and AFBMA Std 11. Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Bearings shall be supported by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Bearings may not be fastened directly to the unit sheet metal casing. Fans and scrolls shall be furnished with coating indicated. Fans shall be driven by a unit-mounted or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Belt guards shall be the three sided enclosed type with solid or expanded metal face. Belt drives shall be designed for not less than a 1.3 service factor based on motor nameplate rating. Motor sheaves shall be variable pitch for 25 hp and below and fixed pitch above 25 hp as defined by ARI Guideline D. Where fixed sheaves are required, variable pitch sheaves may be used during air balance, but shall be replaced with an appropriate fixed sheave after air balance is completed. Variable pitch sheaves shall be selected to drive the fan at a speed that will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. Motors for V-belt drives shall be provided with adjustable bases. Fan motors shall have totally enclosed enclosures. Unit fan or fans shall be selected to produce the required capacity at the fan static pressure. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300 or ASHRAE 68.

2.7.1.4 Dampers

A. Volume Dampers: All volume dampers shall be made of material (similar to the ductwork) two gauges thicker than the duct in which the damper is located. Each damper shall have an operator with indicator handle and a

locking mechanism. Damper operator shall be Young Regulator Company "Valcalox" No. 403B; Ventfabrics Inc. "Ventloc" No. 637; or equal. Volume dampers for rectangular odor control ductwork shall be of the opposed blade type with locking quadrants.

B. "Tight shut-off" dampers shall be Pacific Air Products Company "Pneumaseal" Mk II; Arrow United Industries "Pin-Lock" model OBDPL-506; or equal.

C. Fire Dampers shall be Pacific Air Products Company model FD-100-14-H, Terry; or equal, approved and listed by Underwriters Laboratories Inc. and bearing the UL label (1-1/2 hour rating) with fusible link set for 165°F. As specified in Section DUCTWORK COMPONENTS.

2.8 Air Conditioning Equipment

Provide air-cooled split system, 48,000 BTUH cooling capacity, ARI certified and UL listed.

1. Condensing unit shall be used in a refrigeration circuit matched to an indoor duct free fan coil unit. Refrigerant shall be R-22. Provide concrete mounting pad.
2. Indoor fan coil unit shall be high wall type.
3. Install refrigerant lines and insulation as required.
4. Provide a condensate drain to outdoors at ground level.
5. Provide wireless controller for temperature control.
6. Equipment shall operate on a 208, single-phase supply.
7. Unit shall be YORK HDB 11 SEER Carrier; Trane; or equal.

2.9 COMFORT HEATERS

2.9.1 Wall-Mount (Electric) Convection Heater

Provide unit of capacity as shown on Drawing: Heater shall have bottom air intake and top air exit and mounted a minimum of 6 inches off floor. Enclosure shall be fabricated from 18-gauge die-formed steel with zinc-chromate primer and neutral gray baked-on finish, with air exit grille designed in a way to prevent the entrance of small objects. Heating elements shall be steel fintube elements with brazed fins. Unit to be power by 120 volt, single phase power supply. Built-in contractor shall be provided with overload manual reset. Terminal blocks shall be provided for wiring connections. Unit shall include built-in thermostat with adjustable setpoint range of 55-105°F. Emerson "Chromalox" HCH Series, Trane "EWF" series; or equal.

2.9.2 Package Terminal Heat Pump

The Contractor will furnish Packaged Terminal Heat Pump of the size and capacity shown on the drawing and in the specifications. The unit shall be located as shown on the Drawings.

Packaged Terminal Heat Pump shall be single-piece, packaged terminal heat pump unit with reverse cycle heating meeting ARI Standard 310/380 and UL certified. Unit capacity and energy efficiency (SEER) rating as noted on

the Drawings. Unit shall include the following features:

1. Rotary air compressor.
2. Copper tube refrigerant coils.
3. Accessible removable air filter system (supply unit with replacement filters).
4. Concealed unit control panel, including integral thermostat control.
5. Heating and cooling with multi-speed fan control, and fixed speed fan control for air circulation only (OFF-FAN-HEAT-COOL).
6. Manual vent control of outdoor air.
7. Reverse cycle defrost system.
8. Slide-out equipment chassis.
9. Galvanized Steel or Fiberglass wall sleeve (42-inch x 16-inch).
10. Sub-base for above floor mounting (6-inch minimum).
11. Interior louver for multi-directional air distribution.
12. Stamped aluminum exterior grille.
13. Condensate drain kit. Pipe drain to sanitary sewer.
14. Unit shall operate on 208V/1-phase/60 Hz power supply.
15. Power cord with NEMA6-20R plug connection.
16. 20-amp/2-pole circuit protection.
17. Unit shall be Carrier 52SQ series; General Electric 'Zoneline' AZ-52 series; Trane PTHC series; or equal.

2.10 FACTORY PAINTING

Units which are not of galvanized construction according to ASTM A 123/A 123M or ASTM A 924/A 924M shall be factory painted with a corrosion resisting paint finish. Internal and external ferrous metal surfaces shall be cleaned, phosphatized and coated with a paint finish which has been tested according to ASTM B 117, ASTM D 1654, and ASTM D 3359. Evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors shall be submitted. Rating of failure at the scribe mark shall be not less than 6, average creepage not greater than 1/8 inch. Rating of the inscribed area shall not be less than 10, no failure. On units constructed of galvanized steel which have been welded, exterior surfaces of welds or welds that have burned through from the interior shall receive a final shop docket of zinc-rich protective paint according to ASTM D 520 Type I.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

3.1.1 Condensate Drain Lines

Water seals shall be provided in the condensate drain from all units. The depth of each seal shall be 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Water seals shall be constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Pipe cap or plug

cleanouts shall be provided where indicated. Drains indicated to connect to the sanitary waste system shall be connected by an indirect waste fitting. Air conditioner drain lines shall be insulated as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.2 Equipment and Installation

Frames and supports shall be provided for valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Air handling units shall be ceiling hung, as indicated. The method of anchoring and fastening shall be as detailed. Floor-mounted equipment, unless otherwise indicated, shall be set on not less than 6 inch concrete pads or curbs doweled in place.

3.1.3 Access Panels

Access panels shall be provided for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METALS.

3.1.4 Flexible Connectors

Pre-insulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the connector or duct manufacturer and shall be provided at the intervals recommended.

3.1.5 Sleeved and Framed Openings

Space between the sleeved or framed opening and the duct or the duct insulation shall be packed as specified in Section 07840 FIRESTOPPING for fire rated penetrations. For non-fire rated penetrations, the space shall be packed as specified in Section 07900 JOINT SEALING.

3.1.6 Metal Ductwork

Installation shall be according to SMACNA HVAC Duct Const Stds unless otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA HVAC Duct Const Stds, unless otherwise specified. Friction beam clamps indicated in SMACNA HVAC Duct Const Stds shall not be used. Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion. Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

3.1.7 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's work. Temporary protection shall remain in place until system is ready for startup.

3.1.8 Insulation

Thickness and application of insulation materials for ductwork, piping, and equipment shall be according to Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Outdoor air intake ducts and plenums shall be externally insulated up to the point where the outdoor air reaches the conditioning unit .

3.1.9 Duct Test Holes

Holes with closures or threaded holes with plugs shall be provided in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Extensions, complete with cap or plug, shall be provided where the ducts are insulated.

3.1.10 Power Transmission Components Adjustment

V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.2 FIELD PAINTING AND COLOR CODE MARKING

Finish painting of items only primed at the factory, surfaces not specifically noted otherwise, and color code marking for piping shall be as specified in Section 09900 PAINTING, GENERAL.

3.3 DUCTWORK LEAK TEST

Ductwork leak test shall be performed for the entire air distribution and exhaust system, including fans and coils. Test procedure, apparatus, and report shall conform to SMACNA Leakage Test Mnl. The maximum allowable leakage rate is 7 cfm. Ductwork leak test shall be completed with satisfactory results prior to applying insulation to ductwork exterior.

3.4 CLEANING AND ADJUSTING

Pipes shall be cleaned free of scale and thoroughly flushed of foreign matter. A temporary bypass shall be provided for water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged

or capped after the system has been vented. Inside of coil-induction units, air terminal units, unit ventilators, ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.5 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.6 PERFORMANCE TESTS

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated or specified. Capacity tests and general operating tests shall be conducted by an experienced Contracting Officer. Tests shall cover a period of not less than two days for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

3.7 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 8 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16070

SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 General Requirements
 - 1.2.2 Electrical Equipment
 - 1.2.3 Electrical Systems
 - 1.2.4 Contractor Designed Bracing
 - 1.2.5 Conduits Requiring No Special Seismic Restraints
- 1.3 SUBMITTALS
- 1.4 EQUIPMENT REQUIREMENTS
 - 1.4.1 Rigidly Mounted Equipment

PART 2 PRODUCTS

- 2.1 LIGHTING FIXTURE SUPPORTS
- 2.2 SWAY BRACING MATERIALS

PART 3 EXECUTION

- 3.1 SWAY BRACES FOR CONDUIT
- 3.2 LIGHTING FIXTURES IN BUILDINGS
 - 3.2.1 Pendant Fixtures
 - 3.2.2 Ceiling Attached Fixtures
 - 3.2.2.1 Recessed Fluorescent Fixtures
 - 3.2.2.2 Surface-Mounted Fluorescent Fixtures
 - 3.2.3 Assembly Mounted on Outlet Box
 - 3.2.4 Wall-Mounted Emergency Light Unit
 - 3.2.5 Lateral Force

-- End of Section Table of Contents --

SECTION 16070

SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 580 (1996) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint

CORPS OF ENGINEERS, HUNTSVILLE ENGINEERING AND SUPPORT CENTER
(CEHNC)

TI 809-04 (1998) Seismic Design for Buildings

UNDERWRITERS LABORATORIES (UL)

UL 1570 (1995; Rev thru Feb 1999) Fluorescent Lighting Fixtures

UL 1571 (1995; Rev thru Feb 1999) Incandescent Lighting Fixtures

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

The requirements for seismic protection measures described in this section shall be applied to the electrical equipment and systems listed below. Structural requirements shall be in accordance with Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

1.2.2 Electrical Equipment

Electrical equipment shall include the following items to the extent required on the drawings or in other sections of these specifications:

Control Panels	Air Handling Units
Pumps with Motors	Switchgear
Light Fixtures	Transformers

Motor Control Centers

Switchboards (Floor Mounted)

1.2.3 Electrical Systems

The following electrical systems shall be installed as required on the drawings and other sections of these specifications and shall be seismically protected in accordance with this specification.

1.2.4 Contractor Designed Bracing

The Contractor shall design the bracing in accordance with TI 809-04 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads. TI 809-04 uses parameters for the building, not for the equipment in the building; therefore, corresponding adjustments to the formulas shall be required. Loadings determined using TI 809-04 are based on strength design; therefore, the AISC LRFP specifications shall be used for the design.

1.2.5 Conduits Requiring No Special Seismic Restraints

Seismic restraints may be omitted from electrical conduit less than 2-1/2 inches trade size. All other interior conduit, shall be seismically protected as specified.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Lighting Fixtures in Buildings; FIO. Equipment Requirements; FIO.

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

SD-04 Drawings

Lighting Fixtures in Buildings; FIO. Equipment Requirements; FIO.

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed.

1.4 EQUIPMENT REQUIREMENTS

1.4.1 Rigidly Mounted Equipment

The following specific items of equipment to be furnished under this contract shall be constructed and assembled to withstand the seismic forces

specified in TI 809-04, Chapter 10. Each item of rigid electrical equipment shall be entirely located and rigidly attached on one side only of a building expansion joint. Piping, electrical conduit, etc., which cross the expansion joint shall be provided with flexible joints that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions.

- Engine-Generators
- Transformers
- Switch Boards and Switch Gears
- Motor Control Centers
- Free Standing Electric Motors

PART 2 PRODUCTS

2.1 LIGHTING FIXTURE SUPPORTS

Lighting fixtures and supports shall conform to UL 1570 or UL 1571 as applicable.

2.2 SWAY BRACING MATERIALS

Sway bracing materials (e.g. rods, plates, rope, angles, etc.) shall be as specified in Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

PART 3 EXECUTION

3.1 SWAY BRACES FOR CONDUIT

Conduit shall be braced as for an equivalent weight pipe in accordance with Section 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

3.2 LIGHTING FIXTURES IN BUILDINGS

Lighting fixtures and supports shall conform to the following:

3.2.1 Pendant Fixtures

Pendant fixtures shall conform to the requirements of TI 809-04, Chapter 10.

3.2.2 Ceiling Attached Fixtures

3.2.2.1 Recessed Fluorescent Fixtures

Recessed fluorescent individual or continuous-row mounted fixtures shall be supported by a seismic-resistant suspended ceiling support system built in accordance with ASTM E 580 Section 09510 ACOUSTICAL CEILINGS. Seismic protection for the fixtures shall conform to the requirements of TI 809-04, Chapter 10. Recessed lighting fixtures not over 56 pounds in weight may be supported by and attached directly to the ceiling system runners using screws or bolts, number and size as required by the seismic design. Fixture accessories, including louvers, diffusers, and lenses shall have lock or screw attachments.

3.2.2.2 Surface-Mounted Fluorescent Fixtures

Surface-mounted fluorescent individual or continuous-row fixtures shall be attached to a seismic-resistant ceiling support system built in accordance with ASTM E 580 Section 09510 ACOUSTICAL CEILINGS. Seismic protection for the fixtures shall conform to the requirements of TI 809-04, Chapter 10.

3.2.3 Assembly Mounted on Outlet Box

A supporting assembly, that is intended to be mounted on an outlet box, shall be designed to accommodate mounting features on 3 inch boxes, plaster rings, and fixture studs.

3.2.4 Wall-Mounted Emergency Light Unit

Attachments for wall-mounted emergency light units shall be designed and secured for the worst expected seismic disturbance at the site.

3.2.5 Lateral Force

Structural requirements for light fixture bracing shall be in accordance with Section 13080 SEISMIC PROTECTION FOR MISCELLANIOUS EQUIPMENT.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16120

INSULATED WIRE AND CABLE

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.1 MATERIALS

- 2.1.1 Wire Table
- 2.1.2 Rated Circuit Voltages
- 2.1.3 Conductors
 - 2.1.3.1 Material
 - 2.1.3.2 Size
 - 2.1.3.3 Stranding
 - 2.1.3.4 Separator Tape
- 2.1.4 Insulation
 - 2.1.4.1 Insulation Material
 - 2.1.4.2 Insulation Thickness
- 2.1.5 Jackets
 - 2.1.5.1 Jacket Material
 - 2.1.5.2 Jacket Thickness
- 2.1.6 Identification
 - 2.1.6.1 Color-coding

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

- 2.2.1 Cable Data
- 2.2.2 Inspection and Tests
 - 2.2.2.1 High-Voltage Test Source
 - 2.2.2.2 Independent Tests
 - 2.2.2.3 Reports

PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 16120

INSULATED WIRE AND CABLE
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

- | | |
|----------|---|
| AEIC CS5 | (Oct 1987; 9th Ed) Thermoplastic and Crosslinked Polyethylene Insulated Shielded Power Cables Rated 5 Through 35 kV |
| AEIC CS6 | (Oct 1987; 5th Ed; Rev Mar 1989) Ethylene Propylene Insulated Shielded Power Cables Rated 5 Through 69 kV |

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- | | |
|--------------|---|
| IEEE Std 383 | (1974; R 1992) Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations |
|--------------|---|

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- | | |
|-----------|--|
| NEMA WC 7 | (1988) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy |
| NEMA WC 8 | (1988) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy |

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Installation Instructions; FIO.

The Contractor shall submit cable manufacturing data.

SD-09 Reports

Tests, Inspections, and Verifications; FIO.

Certified copies of test reports shall be submitted by the contractor.

1.3 DELIVERY, STORAGE, AND HANDLING

Furnish cables on reels or coils. Each cable and the outside of each reel or coil, shall be plainly marked or tagged to indicate the cable length, voltage rating, conductor size, and manufacturer's lot number and reel number. Each coil or reel of cable shall contain only one continuous cable without splices. Cables for exclusively dc applications, as specified in paragraph HIGH VOLTAGE TEST SOURCE, shall be identified as such. Shielded cables rated 2,001 volts and above and shall be reeled and marked in accordance with Section I of AEIC CS5 or AEIC CS6, as applicable. Reels shall remain the property of the Contractor.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Wire Table

Wire and cable shall be furnished in accordance with the requirements of the wire table appended to these specifications, and shall conform to the detailed requirements specified herein.

2.1.2 Rated Circuit Voltages

All wire and cable shall have minimum rated circuit voltages in accordance with Table 3-1 of NEMA WC 7 or NEMA WC 8.

2.1.3 Conductors

2.1.3.1 Material

Conductors shall conform to all the applicable requirements of Section 2 of NEMA WC 7 or Part 2 of NEMA WC 8 as applicable and shall be annealed copper. Copper conductors may be bare, or tin- or lead-alloy-coated, if required by the type of insulation used.

2.1.3.2 Size

Minimum wire size shall be No. 12 AWG for power and lighting circuits; No. 10 AWG for current transformer secondary circuits; No. 14 AWG for potential transformer, relaying, and control circuits; No. 16 for multiconductor instrument cable No. 14 AWG for annunciator circuits; and No. 14 AWG for alarm circuits.

2.1.3.3 Stranding

Conductor stranding classes cited herein shall be as defined in Appendix L of NEMA WC 7 or NEMA WC 8, as applicable. Lighting conductors No. 10 AWG and smaller shall be solid or have Class B stranding. Any conductors used between stationary and moving devices, such as hinged doors or panels, shall have Class H or K stranding. All other conductors shall have Class B or C stranding, except that conductors shown on the drawings, or in the schedule, as No. 12 AWG may be 19 strands of No. 25 AWG, and conductors shown as No. 10 AWG may be 19 strands of No. 22 AWG.

2.1.3.4 Separator Tape

Where conductor shielding, strand filling, or other special conductor treatment is not required, a separator tape between conductor and insulation is permitted.

2.1.4 Insulation

2.1.4.1 Insulation Material

Insulation shall be THHN/THWN unless shown otherwise.

2.1.4.2 Insulation Thickness

The insulation thickness for each conductor shall be based on its rated circuit voltage.

a. Power Cables/Single-Conductor Control Cables, 2,000 Volts and Below - The insulation thickness for single-conductor cables rated 2,000 volts and below shall be as required by Table 3-1, Section 3 of NEMA WC 7 or Table 3-1, Part 3, of NEMA WC 8, as applicable. Column "A" thickness of Table 3-1 of NEMA WC 7 will be permitted only for single-conductor cross-linked thermosetting polyethylene insulated cables without a jacket. NEMA WC 8 ethylene-propylene rubber-insulated conductors shall have a jacket. Column "B" thickness shall apply to single-conductor cables that require a jacket and to individual conductors of multiple-conductor cables with an overall jacket.

b. Multiple-Conductor Control Cables - The insulation thickness of multiple-conductor cables used for control and related purposes shall be as required by Table 7-32 of NEMA WC 7 or Table 7.5.1 of NEMA WC 8 as applicable. Multiple Conductor Instrumentation Cables shall include a shield and be twisted.

2.1.5 Jackets

All cables shall have jackets meeting the requirements of Section 4 of NEMA WC 7, or Part 4 of NEMA WC 8, as applicable, and as specified herein. Individual conductors of multiple-conductor cables shall be required to have jackets only if they are necessary for the conductor to meet other specifications herein. Jackets of single-conductor cables and of individual conductors of multiple-conductor cables, except for shielded cables, shall be in direct contact and adhere or be vulcanized to the conductor insulation. Multiple-conductor cables and shielded

single-conductor cables shall be provided with a common overall jacket, which shall be tightly and concentrically formed around the core. Repaired jacket defects found and corrected during manufacturing are permitted if the cable, including jacket, afterward fully meets these specifications and the requirements of the applicable standards.

2.1.5.1 Jacket Material

The jacket shall be one of the materials listed below.

a. General Use

- (1) Heavy-duty black neoprene (NEMA WC 8, paragraph 4.4.3).
- (2) Heavy-duty chlorosulfonated polyethylene (NEMA WC 8, paragraph 4.4.10).
- (3) Heavy-duty cross-linked (thermoset) chlorinated polyethylene (NEMA WC 8, paragraph 4.4.11).

b. Accessible Use Only, 2,000 Volts or Less - Cables installed where they are entirely accessible, such as cable trays and raceways with removable covers, or where they pass through less than 10 feet of exposed conduit only, shall have jackets of one of the materials specified in above paragraph GENERAL USE, or the jackets may be of one of the following:

- (1) General-purpose neoprene (NEMA WC 8, paragraph 4.4.4).
- (2) Black polyethylene (NEMA WC 8, paragraph 4.4.6).
- (3) Thermoplastic chlorinated polyethylene (NEMA WC 8, paragraph 4.4.7).

2.1.5.2 Jacket Thickness

The minimum thickness of the jackets at any point shall be not less than 80 percent of the respective nominal thicknesses specified below.

a. Multiple-Conductor Cables - Thickness of the jackets of the individual conductors of multiple-conductor cables shall be as required by Section 4, Table 4-6 of NEMA WC 7 or Part 4, Table 4-4 of NEMA WC 8, and shall be in addition to the conductor insulation thickness required by Column B of Table 3-1 of the applicable NEMA publication for the insulation used. Thickness of the outer jackets or sheaths of the assembled multiple-conductor cables shall be as required by Section 4, Table 4-7, of NEMA WC 7 or Part 4, Table 4-5, of NEMA WC 8.

b. Single-Conductor Cables - Single-conductor cables, if nonshielded, shall have a jacket thickness as specified in Section 4, Table 4-4 of NEMA WC 7 or Part 4, Table 4-2 of NEMA WC 8. If shielded, the jacket thickness shall be in accordance with the requirements of Section 4, Table 4-5 of NEMA WC 7 or Part 4, Table 4-3 of NEMA WC 8.

2.1.6 Identification

2.1.6.1 Color-coding

Insulation of individual conductors of multiple-conductor cables shall be color-coded in accordance with paragraph 5.3 of NEMA WC 8, except that colored braids will not be permitted. Only one color-code method shall be used for each cable construction type. Control cable color-coding shall be in accordance with Table 5-2 of NEMA WC 8. Power cable color-coding shall be black for Phase A, red for Phase B, blue for Phase C, white for grounded neutral, and green for an insulated grounding conductor, if included.

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Cable Data

Manufacture of the wire and cable shall not be started until all materials to be used in the fabrication of the finished wire or cable have been approved by the Contracting Officer. Cable data shall be submitted for approval including dimensioned sketches showing cable construction, and sufficient additional data to show that these specifications will be satisfied.

2.2.2 Inspection and Tests

Inspection and tests of wire and cable furnished under these specifications shall be made by and at the plant of the manufacturer, and shall be witnessed by the Contracting Officer or his authorized representative, unless waived in writing. The Government may perform further tests before or after installation. Testing in general shall comply with Section 6 of NEMA WC 7 or Part 6 of NEMA WC 8. Specific tests required for particular materials, components, and completed cables shall be as specified in the sections of the above standards applicable to those materials, components, and cable types. Tests shall also be performed in accordance with the additional requirements specified below.

2.2.2.1 High-Voltage Test Source

Where the applicable standards allow a choice, high-voltage tests for cables to be used exclusively on dc circuits shall be made with dc test voltages. Cables to be used exclusively on ac circuits shall be tested with ac test voltages. If both ac and dc will be present, on either the same or separate conductors of the cable, ac test voltages shall be used.

2.2.2.2 Independent Tests

The Government may at any time make visual inspections, continuity or resistance checks, insulation resistance readings, power factor tests, or dc high-potential tests at field test values. A cable's failure to pass these tests and inspections, or failure to produce readings consistent with acceptable values for the application, will be grounds for rejection of the cable.

2.2.2.3 Reports

Results of tests made shall be furnished. No wire or cable shall be shipped until authorized. Lot number and reel or coil number of wire and cable tested shall be indicated on the test reports.

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16261

VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 RELATED REQUIREMENTS
- 1.3 SYSTEM DESCRIPTION
 - 1.3.1 Performance Requirements
 - 1.3.1.1 Electromagnetic Interference Suppression
 - 1.3.1.2 Electromechanical and Electrical Components
 - 1.3.2 Electrical Requirements
 - 1.3.2.1 Power Line Surge Protection
 - 1.3.2.2 Sensor and Control Wiring Surge Protection
- 1.4 SUBMITTALS
- 1.5 QUALITY ASSURANCE
 - 1.5.1 Schematic Diagrams
 - 1.5.2 Interconnecting Diagrams
 - 1.5.3 Installation instructions
 - 1.5.4 Factory Test Results
- 1.6 DELIVERY AND STORAGE
- 1.7 WARRANTY
- 1.8 MAINTENANCE
 - 1.8.1 Spare Parts
 - 1.8.2 Maintenance Support

PART 2 PRODUCTS

- 2.1 VARIABLE FREQUENCY DRIVES (VFD)
- 2.2 ENCLOSURES
- 2.3 WIRES AND CABLES
- 2.4 NAMEPLATES
- 2.5 SOURCE QUALITY CONTROL
 - 2.5.1 VFD Factory Test Plan

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 FIELD QUALITY CONTROL
 - 3.2.1 VFD Test
 - 3.2.2 Performance Verification Tests
 - 3.2.3 Endurance Test
- 3.3 DEMONSTRATION
 - 3.3.1 Training

- 3.3.1.1 Instructions to Government Personnel
- 3.3.1.2 Operating Personnel Training Program
- 3.3.1.3 Engineering/Maintenance Personnel Training

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 16261

VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

47 CFR 15 Radio Frequency Devices

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC. (IEEE)

IEEE 519 (1992) Harmonic Control in Electrical Power Systems

IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power Circuits

MILITARY STANDARDS (MIL-STD)

MIL-STD-461 (Rev. D) Control of Electromagnetic Interference Emissions and Susceptibility

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA ICS 1 (1993) Industrial Control and Systems

NEMA ICS 3.1 (1990) Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems

NEMA ICS 6 (1993) Industrial Control and Systems Enclosures

NEMA ICS 7 (1993) Industrial Control and Systems Adjustable-Speed Drives

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

UNDERWRITERS LABORATORIES INC. (UL)

UL 489 (1996; R 1998) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures

UL 508C (1996) Power Conversion Equipment

1.2 RELATED REQUIREMENTS

Section 16403, "Motor Control Centers, Switchboards and Panelboard" and Section 13405, "Process Control."

1.3 SYSTEM DESCRIPTION

1.3.1 Performance Requirements

1.3.1.1 Electromagnetic Interference Suppression

Computing devices, as defined by 47 CFR 15, MIL-STD-461 rules and regulations, shall be certified to comply with the requirements for class A computing devices and labeled as set forth in part 15.

1.3.1.2 Electromechanical and Electrical Components

Electrical and electromechanical components of the Variable Frequency Drive (VFD) shall not cause electromagnetic interference to adjacent electrical or electromechanical equipment while in operation.

1.3.2 Electrical Requirements

1.3.2.1 Power Line Surge Protection

IEEE C62.41, IEEE 519 Control panel shall have surge protection, included within the panel to protect the unit from damaging transient voltage surges. Surge arrestor shall be mounted near the incoming power source and properly wired to all three phases and ground. Fuses shall not be used for surge protection.

1.3.2.2 Sensor and Control Wiring Surge Protection

I/O functions as specified shall be protected against surges induced on control and sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested in both normal mode and common mode using the following two waveforms:

- a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The

following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Variable frequency drives; FIO

Wires and cables; FIO

Equipment schedule; FIO

Include data indicating compatibility with motors being driven.

SD-04 Drawings

Schematic diagrams; FIO

Interconnecting diagrams; FIO

Installation drawings; FIO

Submit drawings for government approval prior to equipment construction or integration. Modifications to original drawings made during installation shall be immediately recorded for inclusion into the as-built drawings.

SD-06 Instructions

Installation instructions; FIO

SD-09 Reports

VFD Test; FIO

Performance Verification Tests; FIO

Endurance Test; FIO

VFD Factory Test Plan; FIO

Factory test results; GA

SD-19 Operation and Maintenance Manuals

Operation and Maintenance Manual; FIO

Provide service and maintenance information including preventive maintenance, assembly, and disassembly procedures. Include electrical drawings from electrical general sections. Submit additional information necessary to provide complete operation, repair, and maintenance information, detailed to the smallest replaceable unit. Include copies of as-built submittals. Provide routine preventative maintenance instructions, and equipment required. Provide instructions on how to modify program settings, and modify the control program. Provide instructions on drive adjustment, trouble-shooting, and configuration.

Provide instructions on process tuning and system calibration.

1.5 QUALITY ASSURANCE

1.5.1 Schematic Diagrams

Show circuits and device elements for each replaceable module. Schematic diagrams of printed circuit boards are permitted to group functional assemblies as devices, provided that sufficient information is provided for government maintenance personnel to verify proper operation of the functional assemblies.

1.5.2 Interconnecting Diagrams

Show interconnections between equipment assemblies, and external interfaces, including power and signal conductors. Include for enclosures and external devices.

1.5.3 Installation instructions

Provide installation instructions issued by the manufacturer of the equipment, including notes and recommendations, prior to shipment to the site. Provide operation instructions prior to acceptance testing.

1.5.4 Factory Test Results

Document test results and submit to government within 7 working days after completion of test.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.7 WARRANTY

The complete system shall be warranted by the manufacturer for a period of one year, or the contracted period of any extended warrantee agreed upon by the contractor and the Government, after successful completion of the acceptance test. Any component failing to perform its function as specified and documented shall be repaired or replaced by the contractor at no additional cost to the Government. Items repaired or replaced shall be warranted for an additional period of at least one year from the date that it becomes functional again, as specified in the FAR CLAUSE 52.246-21.

1.8 MAINTENANCE

1.8.1 Spare Parts

Manufacturers provide spare parts in accordance with recommended spare parts list.

1.8.2 Maintenance Support

During the warranty period, the Contractor shall provide on-site, on-call maintenance services by Contractor's personnel on the following basis: The service shall be on a per-call basis with 36 hour response. Contractor shall support the maintenance of all hardware and software of the system. Various personnel of different expertise shall be sent on-site depending on the nature of the maintenance service required. Costs shall include travel, local transportation, living expenses, and labor rates of the service personnel while responding to the service request. The provisions of this Section are not in lieu of, nor relieve the Contractor of, warranty responsibilities covered in this specification. Should the result of the service request be the uncovering of a system defect covered under the warranty provisions, all costs for the call, including the labor necessary to identify the defect, shall be borne by the Contractor.

PART 2 PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES (VFD)

Provide frequency drive to control the speed of induction motor(s). The VFD shall include the following minimum functions, features and ratings.

- a. Input circuit breaker per UL 489 with a minimum of 25,000 amps symmetrical interrupting capacity and door interlocked external operator.
- b. A converter stage per UL 508C shall change fixed voltage, fixed frequency, ac line power to a fixed dc voltage. The converter shall utilize a full wave bridge design incorporating diode rectifiers. Silicon Controlled Rectifiers (SCR) are not acceptable. The converter shall be insensitive to three phase rotation of the ac line and shall not cause displacement power factor of less than .95 lagging under any speed and load condition.
- c. An inverter stage shall change fixed dc voltage to variable frequency, variable voltage, ac for application to a standard NEMA design B squirrel cage motor. The inverter shall be switched in a manner to produce a sine coded pulse width modulated (PWM) output waveform.
- d. The VFD shall be capable of supplying 120 percent of rated full load current for one minute at maximum ambient temperature.
- e. The VFD shall be designed to operate from nominal supply voltage, + or - 10 percent, three phase, 60 Hz supply, and control motors with a corresponding voltage rating.
- f. Acceleration and deceleration time shall be independently adjustable from one second to 60 seconds.
- g. Adjustable full-time current limiting shall limit the current to a preset value which shall not exceed 120 percent of the controller rated current. The current limiting action shall maintain the V/Hz ratio constant so that variable torque can be maintained.

Short time starting override shall allow starting current to reach 175 percent of controller rated current to maximum starting torque.

- h. The controllers shall be capable of producing an output frequency over the range of 3 Hz to 60 Hz (20 to one speed range), without low speed cogging. Over frequency protection shall be included such that a failure in the controller electronic circuitry shall not cause frequency to exceed 110 percent of the maximum controller output frequency selected.
- i. Minimum and maximum output frequency shall be adjustable over the following ranges: 1) Minimum frequency 3 Hz to 50 percent of maximum selected frequency; 2) Maximum frequency 40 Hz to 60 Hz.
- j. The controller efficiency at any speed shall not be less than 96 percent.
- k. The controllers shall be capable of being restarted into a motor coasting in the forward direction without tripping.
- l. Protection of power semiconductor components shall be accomplished without the use of fast acting semiconductor output fuses. Subjecting the controllers to any of the following conditions shall not result in component failure or the need for fuse replacement:
 - 1. Short circuit at controller output
 - 2. Ground fault at controller output
 - 3. Open circuit at controller output
 - 4. Input undervoltage
 - 5. Input overvoltage
 - 6. Loss of input phase
 - 7. AC line switching transients
 - 8. Instantaneous overload
 - 9. Sustained overload exceeding 115 percent of controller rated current
 - 10. Over temperature
 - 11. Phase reversal
- m. Solid state motor overload protection shall be included such that current exceeding an adjustable threshold shall activate a 60 second timing circuit. Should current remain above the threshold continuously for the timing period, the controller will automatically shut down.

- n. A slip compensation circuit shall be included which will sense changing motor load conditions and adjust output frequency to provide speed regulation of NEMA B motors to within + / - 0.5 percent of maximum speed without the necessity of a tachometer generator.
- o. The VFD shall be factory set for manual restart after the first protective circuit trip for malfunction (overcurrent, undervoltage, overvoltage or overtemperature) or an interruption of power. The VFD shall be capable of being set for automatic restart after a selected time delay. If the drive faults again within a specified time period (adjustable 0-60 seconds), a manual restart will be required.
- p. The VFD shall include external fault reset capability. All the necessary logic to accept an external fault reset contact shall be included.
- q. Provide critical speed lockout circuitry to prevent operating at frequencies with critical harmonics that cause resonant vibrations. The VFD shall have a minimum of three user selectable bandwidths.
- r. Provide the following operator control and monitoring devices mounted on the front panel of the VFD:
 - 1. Manual speed potentiometer.
 - 2. Hand-Off-Auto (HOA) switch.
 - 3. Power on light.
 - 4. Drive run power light.
 - 5. Local display.

2.2 ENCLOSURES

Provide equipment enclosures conforming to NEMA 250, NEMA ICS 7, NEMA ICS 6.

2.3 WIRES AND CABLES

All wires and cables shall conform to NEMA 250, NEMA ICS 7, NFPA 70.

2.4 NAMEPLATES

Nameplates internal to enclosures shall be manufacturer's standard, with the exception that they must be permanent.

2.5 SOURCE QUALITY CONTROL

2.5.1 VFD Factory Test Plan

To ensure quality, each VFD, rated 100 Hp or more, shall be subject to a series of in-plant quality control inspections before approval for shipment from the manufacturer's facilities. Provide test plans and test reports.

PART 3 EXECUTION

3.1 INSTALLATION

Per NEMA ICS 3.1, install equipment in accordance with the approved manufacturer's printed installation drawings, instructions, wiring diagrams, and as indicated on project drawings and the approved shop drawings. A field representative of the drive manufacturer shall supervise the installation of all equipment, and wiring.

3.2 FIELD QUALITY CONTROL

Specified products shall be tested as a system for conformance to specification requirements prior to scheduling the acceptance tests. Contractor shall conduct performance verification tests in the presence of Government representative, observing and documenting complete compliance of the system to the specifications. Contractor shall submit a signed copy of the test results, certifying proper system operation before scheduling tests.

3.2.1 VFD Test

A proposed test plan shall be submitted to the contracting officer at least 28 calendar days prior to proposed testing for approval. The tests shall conform to NEMA ICS 1, NEMA ICS 7, and all manufacturer's safety regulations. The Government reserves the right to witness all tests and review any documentation. The contractor shall inform the Government at least 14 working days prior to the dates of testing. Contractor shall provide video tapes, if available, of all training provided to the Government for subsequent use in training new personnel. All training aids, texts, and expendable support material for a self-sufficient presentation shall be provided, the amount of which to be determined by the contracting officer.

3.2.2 Performance Verification Tests

"Performance Verification Test" plan shall provide the step by step procedure required to establish formal verification of the performance of the VFD. Compliance with the specification requirements shall be verified by inspections, review of critical data, demonstrations, and tests. The Government reserves the right to witness all tests, review data, and request other such additional inspections and repeat tests as necessary to ensure that the system and provided services conform to the stated requirements. The contractor shall inform the Government 14 calendar days prior to the date the test is to be conducted.

3.2.3 Endurance Test

Immediately upon completion of the performance verification test, the endurance test shall commence. The system shall be operated at varying

rates for not less than 192 consecutive hours, at an average effectiveness level of .9998, to demonstrate proper functioning of the complete system. Continue the test on a day-to-day basis until performance standard is met. During the endurance test, the contractor shall not be allowed in the building. The system shall respond as designed.

3.3 DEMONSTRATION

3.3.1 Training

Coordinate training requirements with the Contracting Officer.

3.3.1.1 Instructions to Government Personnel

Provide the services of competent instructors who will give full instruction to designated personnel in operation, maintenance, calibration, configuration, and programming of the complete control system. Orient the training specifically to the system installed. Instructors shall be thoroughly familiar with the subject matter they are to teach. The Government personnel designated to attend the training will have a high school education or equivalent. The number of training days of instruction furnished shall be as specified. A training day is defined as eight hours of instruction, including two 15-minute breaks and excluding lunch time; Monday through Friday. Provide a training manual for each student at each training phase which describes in detail the material included in each training program. Provide one additional copy for archiving. Provide equipment and materials required for classroom training. Provide a list of additional related courses, and offers, noting any courses recommended. List each training course individually by name, including duration, approximate cost per person, and location of course. Unused copies of training manuals shall be turned over to the Government at the end of last training session.

3.3.1.2 Operating Personnel Training Program

Provide one 2 hour training session at the site at a time and place mutually agreeable between the Contractor and the Government. Provide session to train 4 operation personnel in the functional operations of the system and the procedures that personnel will follow in system operation. This training shall include:

- a. System overview
- b. General theory of operation
- c. System operation
- d. Alarm formats
- e. Failure recovery procedures
- f. Troubleshooting

3.3.1.3 Engineering/Maintenance Personnel Training

Accomplish the training program as specified. Training shall be conducted on site at a location designated by the Government. Provide a one day training session to train 4 engineering personnel in the functional operations of the system. This training shall include:

- a. System overview
 - b. General theory of operation
 - c. System operation
 - d. System configuration
 - e. Alarm formats
 - f. Failure recovery procedures
 - g. Troubleshooting and repair
 - h. Maintenance and calibration
 - i. System programming and configuration
- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16264

DIESEL-GENERATOR SET, STATIONARY 15-300 KW, STANDBY APPLICATIONS

03/01

PART 1 GENERAL

1.1 REFERENCES

1.1.1 Local Permits

1.2 SYSTEM DESCRIPTION

1.2.1 Engine-Generator Parameter Schedule

1.2.2 Output Capacity

1.2.3 Power Rating

1.3 GENERAL REQUIREMENTS

1.3.1 Engine-Generator Set

1.3.2 Nameplates

1.3.3 Personnel Safety Device

1.3.4 Verification of Dimensions

1.3.5 Conformance to Codes and Standards

1.3.6 Site Welding

1.3.7 Engine Generator Set Enclosure

1.3.8 Vibration Isolation

1.3.9 Experience

1.3.10 Field Engineer

1.4 SUBMITTALS

1.5 STORAGE AND INSTALLATION

1.6 OPERATION AND MAINTENANCE MANUALS

1.6.1 Operation Manual

1.6.2 Maintenance Manual

1.7 SPECIAL TOOLS AND FILTERS

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Circuit Breakers, Low Voltage

2.1.2 Filter Elements (Fuel-oil, Lubricating-oil, and Combustion-air)

2.1.3 Instrument Transformers

2.1.4 Pipe (Sleeves, Fuel/Lube-oil, Compressed-Air, Coolant and Exhaust)

2.1.5 Pipe Flanges and Fittings

2.1.6 Pipe Hangers

2.1.7 Electrical Enclosures

2.1.7.1 General

2.1.8 Electric Motors

2.1.9 Motor Controllers

2.2 ENGINE

- 2.3 FUEL SYSTEM
 - 2.3.1 Pumps
 - 2.3.1.1 Main Pump
 - 2.3.2 Filter
 - 2.3.3 Relief/Bypass Valve
 - 2.3.4 Fuel Supply
- 2.4 LUBRICATION
 - 2.4.1 Filter
 - 2.4.2 Lube-Oil Sensors
- 2.5 COOLING
 - 2.5.1 Coolant Pumps
 - 2.5.2 Heat Exchanger
 - 2.5.2.1 Fin-Tube-Type Heat Exchanger (Radiator)
 - 2.5.3 Temperature Sensors
- 2.6 SOUND LIMITATIONS
- 2.7 AIR INTAKE EQUIPMENT
- 2.8 EXHAUST SYSTEM
 - 2.8.1 Flexible Sections and Expansion Joints
 - 2.8.2 Exhaust Muffler
 - 2.8.3 Exhaust Piping
- 2.9 EMISSIONS
- 2.10 STARTING SYSTEM
 - 2.10.1 Controls
 - 2.10.2 Capacity
 - 2.10.3 Functional Requirements
 - 2.10.4 Battery
 - 2.10.5 Battery Charger
 - 2.10.6 Starting Aids
 - 2.10.6.1 Glow Plugs
 - 2.10.6.2 Jacket-Coolant Heaters
- 2.11 GOVERNOR
- 2.12 GENERATOR
 - 2.12.1 Current Balance
 - 2.12.2 Voltage Balance
 - 2.12.3 Waveform
- 2.13 EXCITER
- 2.14 VOLTAGE REGULATOR
 - 2.14.1 Steady State Performance (Regulation or Voltage Droop).
- 2.15 GENERATOR PROTECTION
- 2.16 SAFETY SYSTEM
 - 2.16.1 Alarms and Action Logic
 - 2.16.1.1 Shutdown
 - 2.16.1.2 Problem
 - 2.16.2 Local Alarm Panel
 - 2.16.3 Time-Delay on Alarms
- 2.17 ENGINE GENERATOR SET CONTROLS AND INSTRUMENTATION
 - 2.17.1 Controls
 - 2.17.2 Engine Generator Set Metering and Status Indication
- 2.18 PANELS
 - 2.18.1 Enclosures
 - 2.18.2 Analog
 - 2.18.3 Electronic
 - 2.18.4 Parameter Display
 - 2.18.5 Exerciser

- 2.19 SURGE PROTECTION
- 2.20 AUTOMATIC ENGINE-GENERATOR-SET SYSTEM OPERATION
 - 2.20.1 Automatic Transfer Switch
 - 2.20.2 Monitoring and Transfer
- 2.21 MANUAL ENGINE-GENERATOR SET SYSTEM OPERATION
- 2.22 BASE
- 2.23 PAINTING AND FINISHING
- 2.24 FACTORY INSPECTION AND TESTS

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 PIPING INSTALLATION
 - 3.2.1 General
 - 3.2.2 Supports
 - 3.2.3 Flanged Joints
 - 3.2.4 Cleaning
 - 3.2.5 Pipe Sleeves
- 3.3 ELECTRICAL INSTALLATION
 - 3.3.1 Vibration Isolation
- 3.4 FIELD PAINTING
- 3.5 ONSITE INSPECTION AND TESTS
 - 3.5.1 Test Conditions
 - 3.5.1.1 Data
 - 3.5.1.2 Power Factor
 - 3.5.1.3 Contractor Supplied Items
 - 3.5.1.4 Instruments
 - 3.5.1.5 Sequence
 - 3.5.2 Construction Tests
 - 3.5.2.1 Piping Test
 - 3.5.2.2 Electrical Equipment Tests
 - 3.5.3 Inspections
 - 3.5.4 Safety Run Tests
 - 3.5.5 Performance Tests
 - 3.5.5.1 Continuous Engine Load Run Test
 - 3.5.5.2 Load Acceptance Test
 - 3.5.6 Automatic Operation Tests for Stand-Alone Operation
- 3.6 FINAL INSPECTION AND TESTING
- 3.7 MANUFACTURER'S FIELD SERVICE
 - 3.7.1 Onsite Training
 - 3.7.2 Manufacturer's Representative
- 3.8 INSTRUCTIONS
- 3.9 ACCEPTANCE

-- End of Section Table of Contents --

SECTION 16264

DIESEL-GENERATOR SET, STATIONARY 15-300 KW, STANDBY APPLICATIONS
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|-------------|--|
| ANSI C12.11 | (1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV) |
| ANSI C39.1 | (1981; R 1992) Requirements for Electrical Analog Indicating Instruments |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------------|--|
| ASTM A 53 | (1998) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| ASTM A 106 | (1997a) Seamless Carbon Steel Pipe for High-Temperature Service |
| ASTM A 135 | (1997) Electric-Resistance-Welded Steel Pipe |
| ASTM A 181/A 181M | (1995b) Carbon Steel Forgings for General-Purpose Piping |
| ASTM A 234/A 234M | (1997) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service |
| ASTM B 395 | (1995) U-Bend Seamless Copper and Copper Alloy Heat Exchanger and Condenser Tubes |
| ASTM B 395M | (1995) U-Bend Seamless Copper and Copper Alloy Heat Exchanger and Condenser Tubes (Metric) |
| ASTM D 975 | (1996a) Diesel Fuel Oils |

ASME INTERNATIONAL (ASME)

ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.5	(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B16.11	1996) Forged Fittings, Socket-Welding and Threaded
ASME B31.1	(1998) Power Piping
ASME BPV VIII Div 1	(1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5	(1994; CS5a-1995) Cross-Linked Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV
AEIC CS6	(1996) Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 kV

ELECTRICAL GENERATING SYSTEMS ASSOCIATION (EGSA)

EGSA 101P	(1995) Performance Standard for Engine Driven Generator Sets
-----------	--

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE Std 1	(1986; R 1992) General Principles for Temperature Limits in the Rating of Electric Equipment and for the Evaluation of Electrical Insulation
IEEE Std 48	(1996) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1
IEEE Std 100	(1996) IEEE Standard Dictionary of Electrical and Electronics Terms

IEEE Std 120	(1989) Electrical Measurements in Power Circuits
IEEE Std 404	(1993; errata) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V Through 138 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V
IEEE Std 519	(1992) Harmonic Control in Electrical Power Systems

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA ICS 2	(1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC
NEMA ICS 6	(1993) Industrial Control and Systems, Enclosures
NEMA MG 1	(1993; Rev 1; Rev 2; Rev 3 Rev 4) Motors and Generators
NEMA PB 1	(1995) Panelboards
NEMA SG 3	(1995) Power Switching Equipment
NEMA WC 7	(1991; Rev 1) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	(1991; Rev 1; Rev 2) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(1996; Errata TIA 96-2) Flammable and Combustible Liquids Code
NFPA 37	(1998) Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	(1999) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE ARP 892	(1965; R 1994) D-C Starter-Generator, Engine
SAE J 537	(1996) Storage Batteries

UNDERWRITERS LABORATORIES (UL)

UL 489	(1996; Rev thru Dec 1998) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 891	(1994; Rev thru Jan 1995) Dead-Front Switchboards
UL 1236	(1994; Rev thru Dec 1997) Battery Chargers for Charging Engine-Starter Batteries

FEATHER RIVER AIR QUALITY DISTRICT

Standards Requirements

1.1.1 Local Permits

The Contractor and generator manufacturer shall secure proper permits from Feather River Air Quality District. The permits shall include "authority to construct."

1.2 SYSTEM DESCRIPTION

Each engine-generator set shall be provided and installed complete and totally functional, with all necessary ancillary equipment to include air filtration; starting system; generator controls, protection, and isolation; instrumentation; lubrication; fuel system; cooling system; and engine exhaust system. Each engine generator set shall satisfy the requirements specified in the Engine Generator Parameter Schedule.

1.2.1 Engine-Generator Parameter Schedule

ENGINE GENERATOR PARAMETER SCHEDULE

Service Load	300 kW
--------------	--------

Power Factor	0.8 lagging
Motor Starting kVA (maximum)	700 kVA
Maximum Speed	1800 rpm
Engine-Generator Application	stand-alone
Engine Cooling Type	water/ethylene glycol
Heat Exchanger Type	fin-tube
Governor Type	Isochronous
Frequency Bandwidth steady state	$\pm 0.4\%$
Voltage Regulation (No load to full load)	$\pm 2\%$ (max.)
Voltage Bandwidth (steady state)	$\pm 2\%$
Frequency	60 Hz
Voltage	277/480 volts
Phases	3 Phase, Wye
Maximum Generator Reactance	0.14 percent Subtransient
Nonlinear Loads	160 kVA
Max Step Load Increase	40% of Service Load at 0.8 PF
Max Step Load Decrease (without shutdown)	100 % of Service Load at 0.8 PF
Max Time to Start and be Ready to Assume Load	10 seconds
Max Summer Temp (Prior to Genset Operation)	125°F
Min Winter Temp (Prior to Genset Operation)	20°F
Max Summer Outdoor Temp (Ambient)	125°F

Min Winter Outdoor Temp (Ambient)	20°F
Installation Elevation	500 ft above sea level
Main Circuit Breaker	500 Amp, 30KAIC

1.2.2 Output Capacity

Each generator set shall provide power equal to the sum of service load plus the machine's efficiency loss and associated ancillary equipment loads. Rated output capacity shall also consider engine and/or generator oversizing required to meet requirements in paragraph Engine-Generator Parameter Schedule.

1.2.3 Power Rating

Standby ratings shall be in accordance with EGSA 101P.

1.3 GENERAL REQUIREMENTS

1.3.1 Engine-Generator Set

Each set shall consist of one engine, one generator, and one exciter, mounted, assembled, and aligned on one base; and all other necessary ancillary equipment which may be mounted separately. Sets shall be assembled and attached to the base prior to shipping. Set components shall be environmentally suitable for the locations shown and shall be the manufacturer's standard product offered in catalogs for commercial or industrial use. A generator strip heater shall be provided for moisture control when the generator is not operating.

1.3.2 Nameplates

Each major component of this specification shall have the manufacturer's name, type or style, model or serial number, and rating number on a plate secured to the equipment. As a minimum, nameplates shall be provided for: Engines; Relays; Generators; Day tanks; Transformers (CT & PT); Regulators; Pumps and pump motors; Governors; Generator Breaker; Economizers; Heat exchangers (other than base-mounted).

Engines	Relays
Generators	Day tanks
Transformers (CT & PT)	Regulators
Pumps and pump motors	Governors
Generator Breaker	Economizers

Where the following equipment is provided as a standard component by the diesel-engine generator set manufacturer, the nameplate information may be provided in the maintenance manual in lieu of nameplates.

Battery charger	Heaters
Exhaust mufflers	Exciters
Switchgear	Silencers
Battery	

1.3.3 Personnel Safety Device

Exposed moving parts, parts that produce high operating temperatures, parts which may be electrically energized, and parts that may be a hazard to operating personnel during normal operation shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. The safety devices shall be installed so that proper operation of the equipment is not impaired.

1.3.4 Verification of Dimensions

Before performing work, the premises shall be visited and details of the work verified. The Contracting Officer shall be advised in writing of any discrepancies before performing any work.

1.3.5 Conformance to Codes and Standards

Where equipment is specified to conform to requirements of any code or standard such as UL, the design, fabrication and installation shall conform to the code.

1.3.6 Site Welding

Structural members shall be welded in accordance with Section 05090 WELDING, STRUCTURAL. For all other welding, procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by a previously qualified employer may be accepted as permitted by ASME B31.1. Welder qualification tests shall be performed for each welder whose qualifications are not in compliance with the referenced standards. The Contracting Officer shall be notified 24 hours in advance of qualification tests. The qualification tests shall be performed at the work site if practical. The welder or welding operator shall apply the assigned personal symbol near each weld made as a permanent record.

1.3.7 Engine Generator Set Enclosure

The engine generator set enclosure shall be corrosion resistant and fully weather resistant. The enclosure shall contain all set components and provide ventilation to permit operation at rated load under secured conditions. Doors shall be provided for access to all controls and equipment requiring periodic maintenance or adjustment. Removable panels shall be provided for access to components requiring periodic replacement. The enclosure shall be capable of being removed without disassembly of the engine-generator set or removal of components other than exhaust system. The enclosure shall reduce the noise of the generator set to within the limits specified in the paragraph SOUND LIMITATIONS.

1.3.8 Vibration Isolation

The maximum engine-generator set vibration in the horizontal, vertical and axial directions shall be limited to 6 mils (peak-peak RMS), with an overall velocity limit of RMS, for all speeds through 110% of rated speed. The engine-generator set shall be provided with vibration-isolation in accordance with the manufacturer's standard recommendation. Where the vibration-isolation system does not secure the base to the structure floor or unit foundation, seismic restraints shall be provided in accordance with the seismic parameters specified.

1.3.9 Experience

Each component manufacturer shall have a minimum of 3 years experience in the manufacture, assembly and sale of components used with stationary diesel engine-generator sets for commercial and industrial use. The engine-generator set manufacturer/assembler shall have a minimum of 3 years experience in the manufacture, assembly and sale of stationary diesel engine-generator sets for commercial and industrial use.

1.3.10 Field Engineer

The engine-generator set manufacturer or assembler shall furnish a qualified field engineer to supervise the complete installation of the engine-generator set, assist in the performance of the onsite tests, and instruct personnel as to the operational and maintenance features of the equipment. The field engineer shall have attended the engine-generator manufacturer's training courses on installation and operation and maintenance for engine generator sets.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment Performance; FIO.

Calculations of the engine and generator output power capability, including efficiency and parasitic load data.

Sound Power Level; FIO.

Sound power level data for the packaged unit operating at 100% load in a free field environment. The data should demonstrate compliance with the sound limitation requirements of this specification.

Generator Data; FIO.

Each generator KW rating and short circuit capacity (both symmetric and asymmetric).

Day Tank and Integral Main Fuel Storage Tank Capacity; FIO.

Calculations for the capacity of each day tank, including allowances for recirculated fuel, usable tank capacity, and duration of fuel supply.

Power Factor Capability Curve; FIO.

Generator capability curve showing generator kVA output (kW vs. kvar) for both leading and lagging power factors ranging from 0 to 1.0.

Alarm Setpoints; FIO.

The magnitude of monitored values which define alarm or action setpoints, and the tolerance (plus and/or minus) at which the device activates the alarm or action.

Manufacturer's Catalog Data; FIO.

Manufacturer's standard catalog data describing and depicting each engine-generator set and all ancillary equipment in sufficient detail to demonstrate specification compliance.

Vibration-Isolation; FIO.

Vibration isolation system performance data for the range of frequencies generated by the engine-generator set during operation from no load to full load and the maximum vibration transmitted to the floor. Description of seismic qualification of the engine-generator mounting, base, and vibration isolation.

SD-04 Drawings

Layout and Shop Drawings; FIO.

- a. Base-mounted equipment, complete with base and attachments including anchor bolt template and recommended clearances for maintenance and operation.
- b. Starting system.
- c. Fuel system.
- d. Cooling system.
- e. Exhaust system.
- f. Electric wiring of relays, breakers, programmable controllers, and switches including single line and wiring diagrams.
- g. Lubrication system, including piping, pumps, strainers, filters, electric heater, controls and wiring.

- h. Location, type, and description of vibration isolation devices.
- i. The safety system, including wiring schematics.
- j. One-line schematic and wiring diagrams of the generator, exciter, regulator, governor, and all instrumentation.
- k. Panel layouts.
- l. Mounting and support for each panel and major piece of electrical equipment.
- m. Engine-generator set rigging points and lifting instructions.

As-Built Drawings; FIO.

Drawings which accurately depict the as-built configuration of the installation, upon acceptance of the diesel-generator set installation. Layout drawings shall be revised to reflect the as-built conditions and submitted with the as-built drawings.

SD-06 Instructions

Posted Data; GA.

Posted data including wiring and control diagrams showing the key mechanical and electrical control elements, and a diagrammatic layout of the system.

Instructions; FIO.

Instructions including: the manufacturer's pre-start checklist and precautions; startup procedures for test mode, manual-start mode, and automatic-start mode, (as applicable); running checks, procedures, and precautions; and shutdown procedures, checks, and precautions. Instructions shall include procedures for interrelated equipment (such as heat recovery systems, co-generation, load-shedding, and automatic transfer switches). Instructions shall be weatherproof, laminated in plastic, framed, and posted where directed.

SD-08 Statements

Installation Procedures; FIO.

A complete copy of the manufacturer's installation procedures. A detailed description of the manufacturer's recommended break-in procedure.

SD-09 Reports

Onsite Test; GA.

- a. A letter giving notice of the proposed dates of all onsite inspections and tests at least 14days prior to beginning tests.

- b. A detailed description of the Contractor's proposed procedures for onsite tests including the test including the test plan and a listing of equipment necessary to perform the tests. Submission shall be at least 7 days prior to beginning tests.
- c. Three3 copies of the onsite test data described below in 8-1/2 x 11 inch 3-ring binders with a separate section for each test. Sections shall be separated by dividers with tabs. Data plots shall be full size 8-1/2 x 11 inches minimum), showing all grid lines, with full resolution.
 - (1) A description of the procedures for onsite tests.
 - (2) A list of equipment used, with calibration certifications.
 - (3) A copy of measurements taken, with required plots and graphs.
 - (4) The date of testing.
 - (5) The parameters verified.
 - (6) The condition specified for the parameter.
 - (7) The test results, signed and dated.
 - (8) A description of all adjustments made.

SD-13 Certificates

Reliability and Durability; FIO.

Documentation which cites engines and generators in similar service to demonstrate compliance with the requirements of this specification. Certification does not exclude annual technological improvements made by a manufacturer in the basic standard model set on which experience was obtained, provided parts interchangeability has not been substantially affected and the current standard model meets all the performance requirements of this specification. For each different set, 2 like sets shall have performed satisfactorily in a stationary power application, independent and separate from the physical location of the manufacturer's and assembler's facilities, for a minimum of 2 consecutive years without any failure to start, including periodic exercise. The certification shall state that for the set proposed to meet this specification, there were no failures resulting in downtime for repairs in excess of 72 hours or any failure due to overheating during 2 consecutive years of service. Like sets are of the same model, speed, bore, stroke, number and configuration of cylinders, and output power rating. Like generators are of the same model, speed, pitch, cooling, exciter, voltage regulator and output power rating. A list shall be provided with the name of the installations, completion dates, and name and telephone number of a point of contact.

Emissions; GA.

A certification from the engine manufacturer stating that the engine exhaust emissions meet federal, state, and local (Feather River Air Quality District) regulations and restrictions specified. At a minimum, this certification shall include emission factors for criteria pollutants including nitrogen oxides, carbon monoxide, particulate matter, sulfur dioxide, non-methane hydrocarbon, and for hazardous air pollutants (HAPs).

Sound limitation; GA.

A certification from the manufacturer stating that the sound emissions meet the specification.

Site Visit; FIO.

A site visit letter stating the date the site was visited and listing discrepancies found.

Flywheel Balance; FIO.

Manufacturer's certification that the flywheel has been statically and dynamically balanced and is capable of being rotated at 125% of rated speed without vibration or damage.

Standards Compliance; FIO.

A letter stating that where materials or equipment are specified to comply with requirements of UL, or other standards, written proof of such compliance has been obtained. The label or listing of the specified agency, or a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency are acceptable as proof.

Factory Tests; FIO.

After fabrication and testing but before shipping from the factory, submit results of factory test for review. Do not ship any generator sets until the factory tests results have received a favorable review. A certification that each engine generator set passed the factory tests and inspections and a list of the test and inspections.

Functional Facilities; FIO.

A letter certifying that all facilities are complete and functional, that each system is fully functional, and that each item of equipment is complete, free from damage, adjusted, and ready for beneficial use.

1.5 STORAGE AND INSTALLATION

The Contractor shall properly protect material and equipment in accordance with the manufacturers recommended storage procedures, before, during, and after installation. Stored items shall be protected from the weather and contamination. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.6 OPERATION AND MAINTENANCE MANUALS

The operation and maintenance manuals shall be submitted and approved prior to commencing onsite tests.

1.6.1 Operation Manual

Three copies of the manufacturers standard operation manual shall be provided. Sections shall be separated by heavy plastic dividers with tabs which identify the material in the section. Drawings shall be folded blue lines, with the title block visible, and placed in 8-1/2 x 11 inch plastic pockets with reinforced holes]. The manual shall include:

- a. Step-by-step procedures for system startup, operation, and shutdown;
- b. Drawings, diagrams, and single-line schematics to illustrate and define the electrical, mechanical, and hydraulic systems with their controls, alarms, and safety systems;
- c. Procedures for interface and interaction with related systems to include automatic transfer switches, fire alarm/suppression systems, and uninterruptible power supplies.

1.6.2 Maintenance Manual

Three copies of the manufacturers standard maintenance manual containing the information described below shall be provided. Each section shall be separated by a heavy plastic divider with tabs. Drawings shall be folded, with the title block visible, and placed in plastic pockets with reinforced holes].

- a. Procedures for each routine maintenance item. Procedures for troubleshooting. Factory-service, take-down overhaul, and repair service manuals, with parts lists.
- b. The manufacturer's recommended maintenance schedule.
- c. A component list which includes the manufacturer's name, address, type or style, model or serial number, rating, and catalog number for the major components listed in paragraph GENERAL REQUIREMENTS.
- d. A list of spare parts for each piece of equipment and a complete list of materials and supplies needed for operation.

1.7 SPECIAL TOOLS AND FILTERS

Two sets of special tools and two sets of filters required for maintenance shall be provided. Special tools are those that only the manufacturer provides, for special purposes, or to reach otherwise inaccessible parts. One handset shall be provided for each electronic governor when required to indicate and/or change governor response settings. Two complete sets of filters shall be supplied in a suitable storage box. these filters shall

be in addition to filters replaced after testing.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be as specified.

2.1.1 Circuit Breakers, Low Voltage

NEMA AB 1, UL 489, and NEMA SG 3.

2.1.2 Filter Elements (Fuel-oil, Lubricating-oil, and Combustion-air)

Manufacturer's standard.

2.1.3 Instrument Transformers

ANSI C12.11.

2.1.4 Pipe (Sleeves, Fuel/Lube-oil, Compressed-Air, Coolant and Exhaust)

ASTM A 53, ASTM A 106 or ASTM A 135, steel pipe. Pipe smaller than 2 inches shall be Schedule 80. Pipe 2 inches and larger shall be Schedule 40.

2.1.5 Pipe Flanges and Fittings

- a. Pipe Flanges and Flanged Fittings: ASTM A 181/A 181M, Class 60, or ASME B16.5, Grade 1, Class 150.
- b. Pipe Welding Fittings: ASTM A 234/A 234M, Grade WPB or WPC, Class 150, or ASME B16.11, 3000 lb.
- c. Threaded Fittings: ASME B16.3, Class 150.
- d. Valves: MSS SP-80, Class 150.
- e. Gaskets: Manufacturers Standard.

2.1.6 Pipe Hangers

MSS SP-58 and MSS SP-69.

2.1.7 Electrical Enclosures

2.1.7.1 General

NEMA ICS 6.

2.1.8 Electric Motors

Electric motors shall conform to the requirements of NEMA MG 1. Motors shall have sealed ball bearings, a maximum speed of 1800 rpm and integral automatic or manual reset thermal overload protectors. Motors used outside

shall be totally enclosed. AC motors 1/2 Hp or smaller, shall be for standard voltage 115 volts, 60 Hz, single phase power.

2.1.9 Motor Controllers

Motor controllers and starters shall conform to the requirements of NFPA 70 and NEMA ICS 2.

2.2 ENGINE

Each engine shall operate on No. 2-D diesel conforming to ASTM D 975, shall be designed for stationary applications and shall be complete with ancillaries. The engine shall be a standard production model described in the manufacturer's catalog. The engine shall be naturally aspirated, scavenged, supercharged or turbocharged. The engine shall be two- or four-stroke-cycle and compression-ignition type. The engine shall be vertical inline, V-, or opposed-piston type, with a solid cast block or individually cast cylinders. The engine shall have a minimum of two cylinders. Opposed-piston type engines shall have no less than four cylinders. Each block shall have a coolant drain port. Each engine shall be equipped with an overspeed sensor.

2.3 FUEL SYSTEM

The fuel system for each engine generator set shall conform to the requirements of NFPA 30 and NFPA 37 and contain the following elements.

2.3.1 Pumps

2.3.1.1 Main Pump

Each engine shall be provided with an engine driven pump. The pump shall supply fuel at a minimum rate sufficient to provide the amount of fuel required to meet the performance indicated within the parameter schedule. The fuel flow rate shall be based on meeting the load requirements and all necessary recirculation.

2.3.2 Filter

A minimum of one full flow fuel filter shall be provided for each engine. The filter shall be readily accessible and capable of being changed without disconnecting the piping or disturbing other components. The filter shall have inlet and outlet connections plainly marked.

2.3.3 Relief/Bypass Valve

A relief/bypass valve shall be provided to regulate pressure in the fuel supply line, return excess fuel to a return line, and prevent the build-up of excessive pressure in the fuel system.

2.3.4 Fuel Supply

The fuel supply from the main storage of fuel to the day tank shall be as specified in Section 13202 FUEL STORAGE SYSTEMS.

2.4 LUBRICATION

Each engine shall have a separate lube-oil system conforming to NFPA 30 and NFPA 37. Each system shall be pressurized by engine-driven oil pumps. Each system shall be furnished with a relief valve for oil pressure regulation (for closed systems) and a dip-stick for oil level indications. The crankcase shall be vented in accordance with the manufacturer's recommendation except that it shall not be vented to the engine exhaust system. Crankcase breathers, if provided on engines installed in buildings or enclosures, shall be piped to vent to the outside. The system shall be readily accessible for service such as draining, refilling, etc. Each system shall permit addition of oil and have oil-level indication with the set operating. The system shall utilize an oil cooler as recommended by the engine manufacturer.

2.4.1 Filter

One full-flow filter shall be provided for each pump. The filter shall be readily accessible and capable of being changed without disconnecting the piping or disturbing other components. The filter shall have inlet and outlet connections plainly marked.

2.4.2 Lube-Oil Sensors

Each engine shall be equipped with lube-oil pressure sensors. Pressure sensors shall be located downstream of the filters and provide signals for required indication and alarms.

2.5 COOLING

Each engine cooling system shall operate automatically while the engine is running. Each cooling system shall be sized for the maximum summer outdoor design temperature and site elevation. Water-cooled system coolant shall use a combination of water and ethylene-glycol sufficient for freeze protection at the minimum winter outdoor temperature specified. The maximum temperature rise of the coolant across the engine shall be no more than that recommended and submitted in accordance with paragraph SUBMITTALS.

2.5.1 Coolant Pumps

Coolant pumps shall be the centrifugal type. Each engine shall have an engine-driven primary pump. Secondary pumps shall be electric motor driven and have automatic controllers.

2.5.2 Heat Exchanger

Each heat exchanger shall be of a size and capacity to limit the maximum allowable temperature rise in the coolant across the engine to that recommended and submitted in accordance with paragraph SUBMITTALS for the maximum summer outdoor design temperature and site elevation. Each heat exchanger shall be corrosion resistant, suitable for service in ambient conditions of application.

2.5.2.1 Fin-Tube-Type Heat Exchanger (Radiator)

Heat exchanger may be factory coated with corrosive resistant film providing that corrosion measures are taken to restore the heat rejection capability of the radiator to the initial design requirement via oversizing, or other compensating methods. Internal surfaces shall be compatible with liquid fluid coolant used. Materials and coolant are subject to approval by the Contracting Officer. Heat exchangers shall be pressure type incorporating a pressure valve, vacuum valve and a cap. Caps shall be designed for pressure relief prior to removal. Each heat exchanger and the entire cooling system shall be capable of withstanding a minimum pressure of 7 psi. Each heat exchanger shall be protected with a strong grille or screen guard. Each heat exchanger shall have at least two tapped holes. One tapped hole in the heat exchanger shall be equipped with a drain cock, the rest shall be plugged.

2.5.3 Temperature Sensors

Each engine shall be equipped with coolant temperature sensors. Temperature sensors shall provide signals for pre-high and high indication and alarms.

2.6 SOUND LIMITATIONS

The noise generated by the installed diesel generator set operating at 100 percent load shall not exceed the following sound pressure levels in any of the indicated frequencies when measured at a distance of 75 feet from the end of the exhaust and air intake piping directly along the path of intake and discharge for horizontal piping; or at a radius of 75 feet from the engine at 45 degrees apart in all directions for vertical piping.

Frequency Band (Hz)	Maximum Acceptable Pressure Level (Decibels)
31	87
63	87
125	77
250	70
500	64
1,000	61
2,000	60
4,000	60
8,000	62

2.7 AIR INTAKE EQUIPMENT

Filters and silencers shall be provided in locations that are convenient for servicing. The silencer shall be of the high-frequency filter type, located in the air intake system as recommended by the engine manufacturer. Silencer shall be capable of reducing the noise level at the air intake to a point below the maximum acceptable levels specified in paragraph SOUND LIMITATIONS. A combined filter-silencer unit meeting requirements for the separate filter and silencer items may be provided. Expansion elements in

air-intake lines shall be copper.

2.8 EXHAUST SYSTEM

The system shall be separate and complete for each engine. Piping shall be supported so as to minimize vibration. Where a V-type engine is provided, a V-type connector with necessary flexible sections and hardware shall connect the engine exhaust outlets.

2.8.1 Flexible Sections and Expansion Joints

A flexible section at each engine and an expansion joint at each muffler shall be provided. Flexible sections and expansion joints shall have flanged connections. Flexible sections shall be made of convoluted seamless tube without joints or packing. Expansion joints shall be the bellows type. Expansion and flexible elements shall be stainless steel suitable for diesel-engine exhaust gas at the maximum exhaust temperature that is specified by the engine manufacturer. Expansion and flexible elements shall be capable of absorbing vibration from the engine and compensation for thermal expansion and contraction.

2.8.2 Exhaust Muffler

A chamber type exhaust muffler shall be provided. The muffler shall be constructed of welded steel and designed for outside horizontal mounting. Eyebolts, lugs, flanges, or other items shall be provided as necessary for support in the location and position indicated. Pressure drop through the muffler shall not exceed the recommendations of the engine manufacturer. Outside mufflers shall be zinc coated or painted with high temperature 400 degrees F resisting paint. The muffler and exhaust piping together shall reduce the noise level to less than the maximum acceptable level listed for sound limitations in paragraph SOUND LIMITATIONS. The muffler shall have a drain valve, nipple, and cap at the low-point of the muffler.

2.8.3 Exhaust Piping

Horizontal sections of exhaust piping shall be sloped downward away from the engine to a condensate trap and drain valve. Changes in direction shall be long-radius. Exhaust piping, mufflers and silencers installed inside any building shall be insulated in accordance with paragraph THERMAL INSULATION and covered to protect personnel. Vertical exhaust piping shall be provided with a hinged, gravity operated, self-closing, rain cover.

2.9 EMISSIONS

The finished installation shall comply with Federal, state, and local (Feather River Air Quality District) regulations and restrictions regarding the limits of emissions.

2.10 STARTING SYSTEM

The starting system for engine generator sets used in non-emergency applications shall be as follows.

2.10.1 Controls

An engine control switch shall be provided with functions including: run/start (manual), off/reset, and automatic mode. Start-stop logic shall be provided for adjustable cycle cranking and cool down operation. The logic shall be arranged for manual starting and fully automatic starting in accordance with paragraph AUTOMATIC ENGINE-GENERATOR SET SYSTEM OPERATION. Electrical starting systems shall be provided with an adjustable cranking limit device to limit cranking periods from 1 second up to the maximum duration.

2.10.2 Capacity

The starting system shall be of sufficient capacity, at the maximum outdoor summer temperature specified to crank the engine without damage or overheating. The system shall be capable of providing a minimum of three cranking periods with 15-second intervals between cranks. Each cranking period shall have a maximum duration of 15 seconds.

2.10.3 Functional Requirements

Starting system shall be manufacturers recommended dc system utilizing a negative circuit ground. Starting motors shall be in accordance with SAE ARP 892.

2.10.4 Battery

A starting battery system shall be provided and shall include the battery, battery rack, intercell connectors, and spacers. The battery shall be in accordance with SAE J 537. Critical system components (rack, protection, etc.) shall be sized to withstand the seismic acceleration forces specified. The battery shall be lead-acid type, with sufficient capacity, at the minimum outdoor winter temperature specified to provide the specified cranking periods. Valve-regulated lead-acid batteries are not acceptable.

2.10.5 Battery Charger

A current-limiting battery charger, conforming to UL 1236, shall be provided and shall automatically recharge the batteries. The charger shall be capable of an equalize charging rate for recharging fully depleted batteries within 24 hours and a float charge rate for maintaining the batteries in prime starting condition. An ammeter shall be provided to indicate charging rate. A timer shall be provided for the equalize charging rate setting. A battery is considered to be fully depleted when the output voltage falls to a value which will not operate the engine generator set and its components.

2.10.6 Starting Aids

The manufacturer shall provide the following methods to assist engine starting.

2.10.6.1 Glow Plugs

Glow plugs shall be designed to provide sufficient heat for combustion of fuel within the cylinders to guarantee starting at an ambient temperature of minus 25 degrees F.

2.10.6.2 Jacket-Coolant Heaters

A thermostatically controlled electric heater shall be mounted in the engine coolant jacketing to automatically maintain the coolant within plus or minus 3 degrees of the control temperature. The heater shall operate independently of engine operation so that starting times are minimized. The control temperature shall be the temperature recommended by the engine manufacturer to meet the starting time specified.

2.11 GOVERNOR

Each engine shall be provided with a governor which maintains the frequency within a bandwidth of the rated frequency, over a steady-state load range of zero to 100% of rated output capacity. The governor shall be configured for safe manual adjustment of the speed/frequency during operation of the engine generator set, without special tools, from 90 to 110 % of the rated speed/frequency, over a steady state load range of zero to 100% of rated capacity. Isochronous governors shall maintain the midpoint of the frequency bandwidth at the same value for steady-state loads over the range of zero to 100% of rated output capacity.

2.12 GENERATOR

Each generator shall be of the synchronous type, one or two bearing, conforming to NEMA MG 1, equipped with winding terminal housings in accordance with NEMA MG 1, equipped with an amortisseur winding, and directly connected to the engine. Insulation shall be Class H. Generator design shall protect against mechanical, electrical and thermal damage due to vibration, 25 percent overspeeds, or voltages and temperatures at a rated output capacity of 100 percent. Generator ancillary equipment shall meet the short circuit requirements of NEMA MG 1.

2.12.1 Current Balance

At 100 percent rated load, and load impedance equal for each of the three phases, the permissible current difference between any two phases shall not exceed 2 percent of the largest current on either of the two phases.

2.12.2 Voltage Balance

At any balanced load between 75 and 100 percent of rated load, the difference in line-to-neutral voltage among the three phases shall not exceed 1 percent of the average line-to-neutral voltage. For a single-phase load condition, consisting of 25 percent load at unity power factor placed between any phase and neutral with no load on the other two phases, the maximum simultaneous difference in line-to-neutral voltage between the phases shall not exceed 3 percent of rated line to neutral voltage. The single-phase load requirement shall be valid utilizing normal exciter and regulator control. The interpretation of the 25 percent load for single phase load conditions means 25 percent of rated current at rated

phase voltage and unity power factor.

2.12.3 Waveform

The deviation factor of the line-to-line voltage at zero load and at balanced full rated load at 0.8 power factor shall not exceed 10%. The RMS of all harmonics shall be less than 5.0% and that of any one harmonic less than 3.0% at full rated load. Each engine-generator shall be designed and configured to meet the total harmonic distortion limits of IEEE Std 519.

2.13 EXCITER

The generator exciter shall be of the brushless type. Semiconductor rectifiers shall have a minimum safety factor of 300% for peak inverse voltage and forward current ratings for all operating conditions, including 110% generator output at 104 degrees F ambient. The exciter and regulator in combination shall maintain generator-output voltage within the limits specified.

2.14 VOLTAGE REGULATOR

Each generator shall be provided with a solid-state voltage regulator, separate from the exciter. The regulator shall maintain the voltage within a bandwidth of the rated voltage, over a steady-state load range of zero to 100% of rated output capacity. Regulator shall be configured for safe manual adjustment of the engine generator voltage output without special tools, during operation from 90 to 110% of the rated voltage over the steady state load range of zero to 100% of rated output capacity. Regulation drift shall not exceed plus or minus 0.5% for an ambient temperature change of 36 degrees F.

2.14.1 Steady State Performance (Regulation or Voltage Droop).

The voltage regulator shall have a maximum droop of 2% of rated voltage over a load range from 0 to 100% of rated output capacity and automatically maintain the generator output voltage within the specified operational bandwidth.

2.15 GENERATOR PROTECTION

Short circuit and overload protection for the generator shall be provided. The generator circuit breaker (IEEE Device 52) ratings shall be consistent with the generator rated voltage and frequency, with continuous, short circuit and interrupting current ratings to match the generator capacity. The manufacturer shall determine the short circuit current interrupting rating of the breaker. The breaker shall be engine generator base mounted by the engine-generator set manufacturer. Molded case breakers shall be provided with shunt trip. Surge protection shall be provided for each phase of the generator, to be mounted at the generator terminals.

2.16 SAFETY SYSTEM

Devices, wiring, remote panels, local panels, etc., shall be provided and installed as a complete system to automatically activate the appropriate

signals and initiate the appropriate actions. The safety system shall be provided with a self-test method to verify its operability. Alarm signals shall have manual acknowledgement and reset devices. The alarm signal systems shall reactivate for new signals after acknowledgment is given to any signal. The systems shall be configured so that loss of any monitoring device shall be dealt with as an alarm on that system element.

2.16.1 Alarms and Action Logic

2.16.1.1 Shutdown

Simultaneous activation of the audible signal, activation of the visual signal, stopping the engine, and opening the generator main circuit breakers shall be accomplished.

2.16.1.2 Problem

Activation of the visual signal shall be accomplished.

2.16.2 Local Alarm Panel

A local alarm panel shall be provided with the following shutdown and alarm functions as indicated and including the listed Corps of Engineers requirements, mounted either on or adjacent to the engine generator set.

Device/ Condition/	What/Where/Size Required	Corps of Engrs Function
-----------------------	-----------------------------	----------------------------

Shutdowns W/Alarms

High engine temperature	Automatic/ jacket water/ cylinder	SD VA
Low lube-oil pressure	Automatic/ pressure/ level	SD VA
Overspeed shutdown \$ alarm	(110% (+ 2%) of rated speed	SD VA
Overcrank failure to start	Automatic/ Failure to to start	
Red emergency stop switch	Manual Switch	SD VA

Alarms

Device/ Condition/	What/Where/Size	Corps of Engrs Function
	Required	
Low lube-oil pressure	Pressure/ level	CP VA
Low fuel level	Skid tank, 3 hours remaining	CP VAO
High fuel level	Integral Skid Fuel Storage Tank 95% Volume	CP VA
Low coolant	Jacket water	CP VA
Pre-high temperature	Jacket water/ cylinder	CP VA
Pre-low lube-oil pressure		CP VA
High battery voltage		
Low battery voltage		
Battery charger AC failure		
Control switch not in AUTO		
Low starting air pressure		
Low starting hydraulic pressure		
SD - Shut Down		
CP - On Control Panel		
VA - Visual Alarm		
AA - Audible Alarm		
O - Optional		

2.16.3 Time-Delay on Alarms

For startup of the engine-generator set, time-delay devices shall be

installed bypassing the low lubricating oil pressure alarm during cranking, and the coolant-fluid outlet temperature alarm. The lube-oil time-delay device shall return its alarm to normal status after the engine starts. The coolant time-delay device shall return its alarm to normal status 5 minutes after the engine starts.

2.17 ENGINE GENERATOR SET CONTROLS AND INSTRUMENTATION

Devices, wiring, remote panels, local panels, etc., shall be provided and installed as a complete system to automatically activate the appropriate signals and initiate the appropriate actions.

2.17.1 Controls

A local control panel shall be provided with controls as indicated mounted either on or adjacent to the engine generator set. The generator controls shall be equipped with dry output contacts: one to close on run, one to close on fault.

Device/Condition/ Function	Corps Requirement	MFG Offering
Controls		
Switch: run/start - off/set - auto	CP	CP/STD
Emergency stop switch & alarm	CP	CP/STD
Lamp test/indicator test	CP	CP/STD
Common alarm contacts/ fault relay		CP/O
Panel lighting	CP	CP/STD
Audible alarm & silencing/reset switch	CP	
Voltage adjust for voltage Regulator	CP	CP/STD
Pyrometer display w/selector switch	CP	
Remote emergency stop switch		
Remote fuel shutoff switch		
Remote lube-oil shutoff switch		

2.17.2 Engine Generator Set Metering and Status Indication

A local panel shall be provided with devices as indicated mounted either on or adjacent to the engine generator set. A remote control panel shall be provided with devices as indicated.

Device/Condition/ Function	Corps Requirement
-------------------------------	-------------------

Genset Status & Metering

Genset supplying load

System ready

Engine oil pressure	CP
---------------------	----

Engine coolant temperature	CP
----------------------------	----

Engine RPM (Tachometer)	CP
-------------------------	----

Engine run hours	CP
------------------	----

Pyrometer display w/selector switch	CP
--	----

AC volts (generator), 3-phase	CP
----------------------------------	----

AC amps (generator), 3-phase	CP
---------------------------------	----

Generator frequency	CP
---------------------	----

Phase selector switches (amps & volts)	CP
---	----

Watts/kW

Voltage Regulator Adjustment	CP
---------------------------------	----

CP - On Control Panel

VA - Visual Alarm

AA - Audible Alarm

O - Optional

STD - Manufacturers Standard Offering

2.18 PANELS

Each panel shall be of the type necessary to provide specified functions. Panels shall be mounted on the engine generator set base by vibration/shock absorbing type mountings. Instruments shall be mounted flush or semiflush.

Convenient access to the back of instruments shall be provided to facilitate maintenance. Instruments shall be calibrated using recognized industry calibration standards. Each panel shall be provided with a panel identification plate which clearly identifies the panel function as indicated. Each instrument and device on the panel shall be provided with a plate which clearly identifies the device and its function as indicated. Panels except the remote alarm panel can be combined into a single panel.

2.18.1 Enclosures

Enclosures shall be designed for the application and environment, conforming to NEMA ICS 6, and provided with locking mechanisms which are keyed alike.

2.18.2 Analog

Analog electrical indicating instruments shall be in accordance with ANSI C39.1 with semiflush mounting. Switchgear, and control-room panel-mounted instruments shall have 250 degree scales with an accuracy of not less than 1 percent. Unit-mounted instruments shall be the manufacturer's standard with an accuracy of not less than 2 percent. The instrument's operating temperature range shall be minus 20 to plus 65 degrees C. Distorted generator output voltage waveform of a crest factor less than 5 shall not affect metering accuracy for phase voltages, hertz and amps.

2.18.3 Electronic

Electronic indicating instruments shall be true RMS indicating, 100 percent solid state, microprocessor controlled to provide all specified functions. Control, logic, and function devices shall be compatible as a system, sealed, dust and water tight, and shall utilize modular components with metal housings and digital instrumentation. An interface module shall be provided to decode serial link data from the electronic panel and translate alarm, fault and status conditions to set of relay contacts. Instrument accuracy shall be not less than 2 percent for unit mounted devices and 1 percent for control room, panel mounted devices, throughout a temperature range of minus 20 to plus 65 degrees C. Data display shall utilize LED or back lit LCD. Additionally, the display shall provide indication of cycle programming and diagnostic codes for troubleshooting. Numeral height shall be 1/2 inch.

2.18.4 Parameter Display

Indication or readouts of the lubricating-oil pressure, ac voltmeter, ac ammeter, frequency meter, and coolant temperature.

2.18.5 Exerciser

The exerciser shall be in accordance with Section 16410 AUTOMATIC TRANSFER AND BY-PASS/ISOLATION SWITCHES.

2.19 SURGE PROTECTION

Electrical and electronic components shall be protected from, or designed to withstand the effects of surges from switching and lightning.

2.20 AUTOMATIC ENGINE-GENERATOR-SET SYSTEM OPERATION

Fully automatic operation shall be provided for the following operations: engine-generator set starting and source transfer upon loss of preferred source; retransfer upon restoration of the preferred source; sequential

starting; and stopping of each engine-generator set after cool down.
Devices shall automatically reset after termination of their function.

2.20.1 Automatic Transfer Switch

Automatic transfer switches shall be in accordance with Section 16410
AUTOMATIC TRANSFER SWITCH.

2.20.2 Monitoring and Transfer

Devices shall be provided to monitor voltage and frequency for the preferred power source and each engine generator set, and control transfer from the preferred source and retransfer upon restoration of the preferred source. Functions, actuation, and time delays shall be as described in Section 16410
AUTOMATIC TRANSFER AND BY-PASS/ISOLATION SWITCHES.

2.21 MANUAL ENGINE-GENERATOR SET SYSTEM OPERATION

Complete facilities shall be provided for manual starting and testing of each set without load, loading and unloading of each set.

2.22 BASE

The base shall be constructed of steel. The base shall be designed to rigidly support the engine-generator set, ensure permanent alignment of all rotating parts, be arranged to provide easy access to allow changing of lube-oil, and ensure that alignment will be maintained during shipping and normal operation. The base shall permit skidding in any direction during installation and shall be provided with suitable holes for foundation bolts. The base shall also withstand and mitigate the effects of synchronous vibration of the engine and generator, and shall be provided with suitable holes for anchor bolts and jacking screws for leveling.

2.23 PAINTING AND FINISHING

The engine-generator set shall be cleaned, primed and painted in accordance with the manufacturer's standard color and practice.

2.24 FACTORY INSPECTION AND TESTS

Factory inspection and tests shall be performed on each engine-generator set proposed to meet this specification section. Inspections shall be completed and necessary repairs made prior to testing. Inspectors shall look for leaks, looseness, defects in components, and proper assembly. Factory tests shall be NEMA MG 1 routine tests and the manufacturers routine tests.

PART 3 EXECUTION

3.1 GENERAL

Installation shall provide clear space for operation and maintenance in accordance with NFPA 70 and IEEE C2. Installation of pipe, duct, conduit, and ancillary equipment shall be configured to facilitate easy removal and

replacement of major components and parts of the engine-generator set.

3.2 PIPING INSTALLATION

3.2.1 General

Piping shall be welded. Connections at valves shall be flanged. Connections at equipment shall be flanged except that connections to the diesel engine may be threaded if the diesel-engine manufacturer's standard connection is threaded. Except as otherwise specified, flanged fittings shall be utilized to allow for complete dismantling and removal of each piping system from the facility without disconnecting or removing any portion of any other system's equipment or piping. Connections to all equipment shall be made with flexible connectors. Pipes extending through the roof shall be properly flashed. Piping shall be installed clear of windows, doors, and openings to permit thermal expansion and contraction without damage to joints or hangers, and with a 1/2 inch drain valve at each low point.

3.2.2 Supports

Hangers, inserts, and supports shall be of sufficient size to accommodate any insulation and shall conform to MSS SP-58 and MSS SP-69. Supports shall be spaced not more than 7 feet on center for pipes 2 inches in diameter or less, not more than 12 feet on center for pipes larger than 2 inches but no larger than 4 inches, and not more than 17 feet on center for pipes larger than 4 inches in diameter. Supports shall be provided at pipe bends or change of direction.

3.2.3 Flanged Joints

Flanges shall be 125 pound type, drilled, and of the proper size and configuration to match equipment and diesel-engine connections. Gaskets shall be factory cut in one piece 1/16 inch thick.

3.2.4 Cleaning

After fabrication and before assembly, piping interiors shall be manually wiped clean of all debris.

3.2.5 Pipe Sleeves

Pipes passing through construction such as ceilings, floors, or walls shall be fitted with sleeves. Each sleeve shall extend through and be securely fastened in its respective structure and shall be cut flush with each surface. The structure shall be built tightly to the sleeve. The inside diameter of each sleeve shall be 1/2 inch, and where pipes pass through combustible materials, 1 inch larger than the outside diameter of the passing pipe or pipe covering.

3.3 ELECTRICAL INSTALLATION

Electrical installation shall comply with NFPA 70, IEEE C2, and Section 16415 ELECTRICAL WORK, INTERIOR.

3.3.1 Vibration Isolation

Flexible fittings shall be provided for all conduit, cable trays, and raceways attached to engine-generator sets. Metallic conductor cables installed on the engine generator set and from the engine generator set to equipment not mounted on the engine generator set shall be flexible stranded conductor. Terminations of conductors on the engine generator set shall be crimp-type terminals or lugs.

3.4 FIELD PAINTING

Field painting shall be as specified in Section 09900 PAINTING, GENERAL.

3.5 ONSITE INSPECTION AND TESTS

3.5.1 Test Conditions

3.5.1.1 Data

Measurements shall be made and recorded of parameters necessary to verify that each set meets specified parameters. If the results of any test step are not satisfactory, adjustments or replacements shall be made and the step repeated until satisfactory results are obtained. Unless otherwise indicated, data shall be taken during engine-generator set operation and recorded in 15 minute intervals and shall include: readings of engine-generator set meters and gauges for electrical and power parameters; oil pressure; ambient temperature; and engine temperatures available from meters and gauges supplied as permanent equipment on the engine-generator set. In the following tests where measurements are to be recorded after stabilization of an engine-generator set parameter (voltage, frequency, current, temperature, etc.), stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings. Electrical measurements shall be performed in accordance with IEEE Std 120. Definitions and terms are in accordance with IEEE Std 100. Temperature limits in the rating of electrical equipment and for the evaluation of electrical insulation shall be in accordance with IEEE Std 1.

3.5.1.2 Power Factor

Engine-generator set operating tests shall be made utilizing a load with a 1.0 power factor.

3.5.1.3 Contractor Supplied Items

The Contractor shall provide all equipment and supplies required for inspections and tests including fuel, test instruments, and loadbanks at the specified power factors.

3.5.1.4 Instruments

Readings of panel gauges, meters, displays, and instruments, provided under this specification shall be verified during test runs by test instruments

of precision and accuracy greater than the tested items. Test instrument accuracy shall be at least as follows: current, 1.5%; voltage, 1.5%; real power, 1.5%; reactive power, 1.5%; power factor, 3%; frequency, 0.5%. Test instruments shall be calibrated by a recognized standards laboratory within 90 days prior to testing.

3.5.1.5 Sequence

The sequence of testing shall be as specified in the approved testing plan unless variance is authorized by the Contracting Officer. Field testing shall be performed in the presence of the Contracting Officer. Tests may be scheduled and sequenced in order to optimize run-time periods; however the following general order of testing shall be followed: Construction Tests; Inspections; Safety run Tests; and Performance Tests and Final Inspection.

3.5.2 Construction Tests

Individual component and equipment functional tests for fuel piping, coolant piping, and lubricating-oil piping, electrical circuit continuity, insulation resistance, circuit protective devices, and equipment not provided by the engine-generator set manufacturer shall be performed prior to connection to the engine-generator set.

3.5.2.1 Piping Test

- a. Lube-oil and fuel-oil piping shall be flushed with the same type of fluid intended to flow through the piping, until the outflowing fluid has no obvious sediment or emulsion.
- b. Fuel piping which is external to the engine-generator set shall be tested in accordance with NFPA 30. All remaining piping which is external to the engine generator set shall be pressure tested with air pressure at 150% of the maximum anticipated working pressure, but in no case less than 150 psig, for a period of 2 hours to prove the piping has no leaks. If piping is to be insulated, the test shall be performed before the insulation is applied.

3.5.2.2 Electrical Equipment Tests

- a. Low-voltage cable insulation integrity tests shall be performed for cables connecting the generator breaker to the automatic transfer switch. Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations of conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

$$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 304,800 / (\text{length of cable in meters}).$$

(R in megohms = (rated voltage in kV + 1) x 1000/(length of cable in feet)

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

- b. Circuit breakers and switchgear shall be examined and tested in accordance with manufacturer's published instructions for functional testing.

3.5.3 Inspections

The following inspections shall be performed jointly by the Contracting Officer and the Contractor, after complete installation of each engine-generator set and its associated equipment, and prior to startup of the engine-generator set. Checks applicable to the installation shall be performed. The results of those which are physical inspections (I) shall be documented by the Contractor and submitted in accordance with paragraph SUBMITTALS. The Contractor shall present manufacturer's data for the inspections designated (D) at the time of inspection. Inspections shall verify that equipment type, features, accessibility, installation and condition are in accordance with the contract specification. Manufacturer's statements shall certify provision of features which cannot be verified visually.

1. Drive belts. (I)
2. Governor type and features. (I)
3. Engine timing mark. (I)
4. Starting motor. (I)
5. Starting aids. (I)
6. Coolant type and concentration. (D)
7. Radiator drains. (I)
8. Block coolant drains. (I)
9. Coolant fill level. (I)
10. Coolant line connections. (I)
11. Coolant hoses. (I)
12. Combustion air filter. (I)
13. Intake air silencer. (I)
14. Lube oil type. (D)
15. Lube oil drain. (I)
16. Lube-oil filter. (I)
17. Lube-oil-fill level. (I)
18. Lube-oil line connections. (I)
19. Lube-oil lines. (I)
20. Fuel type. (D)
21. Fuel-level. (I)
22. Fuel-line connections. (I)
23. Fuel lines. (I)
24. Fuel filter. (I)
25. Access for maintenance. (I)
26. Voltage regulator. (I)
27. Battery-charger connections. (I)

28. Wiring & terminations. (I)
29. Instrumentation. (I)
30. Hazards to personnel. (I)
31. Base. (I)
32. Nameplates. (I)
33. Paint. (I)
34. Exhaust system. (I)
35. Access provided to controls. (I)
36. Enclosure. (I)
37. Engine & generator mounting bolts (proper application). (I)

3.5.4 Safety Run Tests

- a. Perform and record engine manufacturer's recommended prestarting checks and inspections.
- b. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.
- c. Activate the manual emergency stop switch and verify that the engine stops.
- d. Remove the high and pre-high lubricating oil temperature sensing elements from the engine and temporarily install temperature gauge in their normal locations on the engine (required for safety, not for recorded data). Where necessary, provide temporary wiring harness to connect the sensing elements to their permanent electrical leads.
- e. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set at no load until the output voltage and frequency stabilize. Monitor the temporarily installed temperature gauges. If temperature reading exceeds the value for an alarm condition, activate the manual emergency stop switch.
- f. Immerse the elements in a vessel containing controlled-temperature hot oil and record the temperature at which the pre-high alarm activates and the temperature at which the engine shuts down. Remove the temporary temperature gauges and reinstall the temperature sensors on the engine.
- g. Remove the high and pre-high coolant temperature sensing elements from the engine and temporarily seal their normal location on the engine and temporarily install temperature gauges in their normal locations on the engine (required for safety, not for recorded data). Where necessary provide temporary wiring harness to connect the sensing elements to their permanent electrical leads.
- h. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set at no load until the output voltage and frequency stabilize.

- i. Immerse the elements in a vessel containing controlled-temperature hot oil and record the temperature at which the pre-high alarm activates and the temperature at which the engine shuts down. Remove the temporary temperature gauges and reinstall the temperature sensors on the engine.
- j. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.
- k. Operate the engine generator-set for at least 30 minutes at 100 percent of service load.
- l. Verify proper operation of the governor and voltage regulator.
- m. Verify proper operation and setpoints of gauges and instruments.
- n. Verify proper operation of ancillary equipment.
- o. Manually adjust the governor to increase engine speed past the overspeed limit. Record the RPM at which the engine shuts down.
- p. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 75 percent of rated load.
- q. Manually fill the day tank to a level above the overfill limit. Record the level at which the overfill alarm sounds. Verify shutdown of the fuel transfer pump. Drain the day tank down below the overfill limit.
- r. Shut down the engine. Remove the time-delay low lube oil pressure alarm bypass and try to start the engine. Record the results.
- s. Attach a manifold to the engine oil system (at the oil sensor pressure port) that contains a shutoff valve in series with a connection for the engine's oil pressure sensor followed by an oil pressure gauge ending with a bleed valve. The engine's oil pressure sensor shall be moved from the engine to the manifold and its normal location on the engine temporarily sealed. The manifold shutoff valve shall be open and bleed valve closed.
- t. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 75 percent of service load.
- u. Close the manifold shutoff valve. Slowly allow the pressure in the manifold to bleed off through the bleed valve while watching the pressure gauge. Record the pressure at which the engine shuts down. Catch oil spillage from the bleed valve in a container. Add the oil from the container back to the engine, remove the

manifold, and reinstall the engine's oil pressure sensor on the engine.

- v. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 100% of service load. Record the maximum sound level in each frequency band at a distance of 75 feet from the end of the exhaust and air intake piping directly along the path of intake and discharge horizontal piping; or at a radius of 75 feet from the engine at 45 degrees apart in all directions for vertical piping. The measurements should comply with the paragraph SOUND LIMITATIONS. If a sound limiting enclosure is provided, the enclosure, the muffler, and intake silencer shall be modified or replaced as required to meet the sound requirements contained within this specification. If a sound limiting enclosure is not provided, the muffler and air intake silencer shall be modified or replaced as required to meet the sound limitations of this specification. If the sound limitations cannot be obtained by modifying or replacing the muffler and air intact silencer, the contractor shall notify the Contracting Officer and provide a recommendation for meeting the sound limitations.
- w. Manually drain off fuel slowly from the day tank to empty it to below the low fuel level limit and record the level at which the audible alarm sounds. Add fuel back to the day tank to fill it above low level alarm limits.

3.5.5 Performance Tests

3.5.5.1 Continuous Engine Load Run Test

The engine-generator set and ancillary systems shall be tested at service load to: demonstrate durability; verify that heat of extended operation does not adversely affect or cause failure in any part of the system; and check all parts of the system. If the engine load run test is interrupted for any reason, the entire test shall be repeated. The engine load run test shall be accomplished principally during daylight hours, with an average ambient temperature of 80 degrees F. After each change in load in the following test, measure the vibration at the end bearings (front and back of engine, outboard end of generator) in the horizontal, vertical, and axial directions. Verify that the vibration is within the allowable range.

Measurements are to be recorded after stabilization of an engine-generator set parameter (voltage, frequency, current, temperature, etc.). Stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings. Data taken at 15 minutes intervals shall include the following:

- a. Electrical: Output amperes, voltage, real and reactive power, power factor, frequency.
- b. Pressure: Lube-oil.

- c. Temperature: Coolant.
Lube-oil.
Ambient.

- (1) Perform and record engine manufacturer's recommended prestarting checks and inspections. Include as a minimum checking of coolant fluid, fuel, and lube-oil levels.
- (2) Start the engine; make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.
- (3) Operate the engine generator-set for at least 2 hours at 75 percent of service load.
- (4) Increase load to 100% of service load and operate the engine generator-set for at least 2 hours.
- (5) Remove load from the engine-generator set.

3.5.5.2 Load Acceptance Test

Engine manufacturer's recommended prestarting checks and inspections shall be performed and recorded. The engine shall be started, and engine manufacturer's after-starting checks and inspections made and recorded during a reasonable warm-up period. For the following steps, the output line-line and line-neutral voltages and frequency shall be recorded after performing each step instruction (after stabilization of voltage and frequency). Stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings.

- a. Apply load in steps no larger than the Maximum Step Load Increase to load the engine-generator set to 100 of Service Load.
- b. Verify that the engine-generator set responds to the load addition and that the output voltage returns to and stabilizes within the rated bandwidths.

3.5.6 Automatic Operation Tests for Stand-Alone Operation

The automatic loading system shall be tested to demonstrate automatic starting, and loading and unloading of each engine-generator set. The loads for this test shall utilize the actual loads to be served, and the loading sequence shall be the indicated sequence. Perform this test for a minimum of two successive, successful tests. Data taken shall include the following:

- a. Ambient temperature (at 15 minute intervals).
- b. Generator output current (before and after load changes).
- c. Generator output voltage (before and after load changes).

- d. Generator output frequency (before and after load changes.)
 - 1. Initiate loss of the primary power source and verify automatic sequence of operation.
 - 2. Restore the primary power source and verify sequence of operation.
 - 3. Verify resetting of controls to normal.

3.6 FINAL INSPECTION AND TESTING

- a. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.
- b. Increase the load in steps no greater than the maximum step load increase to 100% of service load, and operate the engine-generator set for at least 30 minutes. Measure the vibration at the end bearings (front and back of engine, outboard end of generator) in the horizontal, vertical, and axial directions. Verify that the vibration is within the same range as previous measurements and is within the required range.
- c. Remove load and shut down the engine-generator set after the recommended cool down period. Perform the pre-test inspections and take necessary corrective actions.
- d. Remove the lube oil filter and have the oil and filter examined by the engine manufacturer for excessive metal, abrasive foreign particles, etc. Any corrective action shall be verified for effectiveness by running the engine for 4 hours at service load, then re-examining the oil and filter.
- e. Remove the fuel filter and examine the filter for trash, abrasive foreign particles, etc.
- f. Visually inspect and check engine and generator mounting bolts for tightness and visible damage.
- g. Replace air, oil, and fuel filters with new filters.

3.7 MANUFACTURER'S FIELD SERVICE

3.7.1 Onsite Training

The Contractor shall conduct training course for operating staff as designated by the Contracting Officer. The training period shall consist of a total 4 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance. The course instructions shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions

shall demonstrate all routine maintenance operations such as oil change, oil filter change, and air filter change.

3.7.2 Manufacturer's Representative

The engine generator-set manufacturer shall furnish a qualified representative to supervise the installation of the engine generator-set, assist in the performance of the onsite tests, and instruct personnel as to the operational and maintenance features of the equipment.

3.8 INSTRUCTIONS

Two sets of instructions shall be typed in (8 1/2 x 11 inches) format, laminated in weatherproof plastic, and placed in three-ring vinyl binders. The binders shall be placed as directed by the Contracting Officer. The instructions shall be in place prior to acceptance of the engine generator set installation. First set of instructions shall include a one-line diagram, wiring and control diagrams and a complete layout of the system. Second set of instructions shall include the condensed operating instructions describing manufacturer's pre-start checklist and precautions; startup procedures for test-mode, manual-start mode, and automatic-start mode (as applicable); running checks, procedures, and precautions; and shutdown procedures, checks, and precautions. Instructions shall include procedures for interrelated equipment (such as heat recovery systems, co-generation, load-shedding, and automatic transfer switches).

3.9 ACCEPTANCE

Final acceptance of the engine-generator set will not be given until the Contractor has successfully completed all tests and after all defects in installation material or operation have been corrected.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16370

ELECTRICAL DISTRIBUTION SYSTEM, AERIAL

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING
- 1.4 EXTRA MATERIALS

PART 2 PRODUCTS

- 2.1 GENERAL REQUIREMENTS
- 2.2 STANDARD PRODUCT
- 2.3 NAMEPLATES
 - 2.3.1 General
- 2.4 CONDUCTORS, CONNECTORS, AND SPLICES
 - 2.4.1 Aluminum-Composition Conductors
 - 2.4.2 Copper Conductors
 - 2.4.3 Connectors and Splices
- 2.5 MEDIUM-VOLTAGE LINES
 - 2.5.1 Bare Medium-Voltage Lines
- 2.6 CROSSARM ASSEMBLIES
 - 2.6.1 Crossarms
- 2.7 FUSES AND SWITCHES, MEDIUM-VOLTAGE
 - 2.7.1 Fuse Cutouts
 - 2.7.2 Fused Switches
- 2.8 GROUNDING AND BONDING
 - 2.8.1 Driven Ground Rods
 - 2.8.2 Grounding Conductors

PART 3 EXECUTION

- 3.1 GENERAL INSTALLATION REQUIREMENTS
 - 3.1.1 Conformance to Codes
 - 3.1.2 Verification of Dimensions
 - 3.1.3 Disposal of Liquid Dielectrics
- 3.2 CROSSARM MOUNTING
 - 3.2.1 Line Arms and Buck Arms
 - 3.2.2 Equipment Arms
- 3.3 CONDUCTOR INSTALLATION
 - 3.3.1 Line Conductors
 - 3.3.2 Connectors and Splices
- 3.4 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

- 3.5 GROUNDING
 - 3.5.1 Grounding Electrodes
 - 3.5.2 Grounding and Bonding Connections
 - 3.5.3 Grounding Electrode Conductors
- 3.6 FIELD TESTING
 - 3.6.1 General
 - 3.6.2 Safety
 - 3.6.3 Ground-Resistance Tests
 - 3.6.4 Pre-Energization Services
 - 3.6.5 Operating Tests
- 3.7 ACCEPTANCE

-- End of Section Table of Contents --

SECTION 16370

ELECTRICAL DISTRIBUTION SYSTEM, AERIAL
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C29.1	(1988; R 1996) Electrical Power Insulators - Test Methods
ANSI C29.2	(1992) Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type
ANSI C29.3	(1986; R 1995) Wet Process Porcelain Insulators - Spool Type
ANSI C29.4	(1989; R 1995) Wet-Process Porcelain Insulators - Strain Type
ANSI C29.5	(1984; R 1995) Wet-Process Porcelain Insulators - Low- and Medium-Voltage Types
ANSI C29.6	(1996) Wet-Process Porcelain Insulators - High-Voltage Pin Type
ANSI C29.8	(1985; R 1995) Wet-Process Porcelain Insulators - Apparatus, Cap and Pin Type
ANSI C29.9	(1983; R 1996) Wet-Process Porcelain Insulators - Apparatus, Post-Type
ANSI C37.32	(1996) High-Voltage Air Switches, Bus Supports, and Switch Accessories - Schedules of Preferred Ratings, Manufacturing Specifications, and Application Guide
ANSI C57.12.20	(1997) Overhead Type Distribution Transformers, 500 KVA and Smaller: High Voltage 34 500 Volts and Below: Low Voltage, 7970/13 800 Y Volts and Below

ANSI C135.1	(1979) Galvanized Steel Bolts and Nuts for Overhead Line Construction
ANSI C135.2	(1987) Threaded Zinc-Coated Ferrous Strand-Eye Anchor Rods and Nuts for Overhead Line Construction
ANSI C135.4	(1987) Zinc-Coated Ferrous Eyebolts and Nuts for Overhead Line Construction
ANSI C135.14	(1979) Staples with Rolled or Slash Points for Overhead Line Construction
ANSI C135.22	(1988) Zinc-Coated Ferrous Pole-Top Insulator Pins with Lead Threads for Overhead Line Construction
ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction
ANSI O5.1	(1992) Specifications and Dimensions for Wood Poles

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997a) Carbon Structural Steel
ASTM A 123/A 123M	(1997a ^{el}) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 475	(1998) Zinc-Coated Steel Wire Strand
ASTM A 575	(1996) Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 576	(1990b; R 1995) Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM B 1	(1995) Hard-Drawn Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM B 228	(1998) Concentric-Lay-Stranded Copper-Clad Steel Conductors
ASTM B 230	(1998) Aluminum 1350-H19 Wire for Electrical Purposes

ASTM B 231	(1995) Concentric-Lay-Stranded Aluminum 1350 Conductors
ASTM B 232	(1997) Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR)
ASTM B 398	(1997) Aluminum-Alloy 6201-T81 Wire for Electrical Purposes
ASTM B 399	(1997) Concentric-Lay-Stranded Aluminum-Alloy 6201-T81 Conductors
ASTM B 416	(1998) Concentric-Lay-Stranded Aluminum-Clad Steel Conductors
ASTM D 923	(1997) Sampling Electrical Insulating Liquids
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 4059	(1996) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography.

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C4	(1995) Poles - Preservative Treatment by Pressure Processes
AWPA C25	(1995) Sawn Crossarms - Preservative Treatment by Pressure Processes
AWPA P1/P13	(1995) Standard for Coal Tar Creosote for Land and Fresh Water and Marine (Coastal Water Use)
AWPA P5	(1997) Standards for Waterborne Preservatives
AWPA P8	(1997) Standards for Oil-Borne Preservatives
AWPA P9	(1997) Standards for Solvents for Organic Preservative Systems

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE C37.34	(1994) Test Code for High-Voltage Air Switches

IEEE C37.41	(1994; C37.41e) Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories
IEEE C37.60	(1981; R 1992) Requirements for Overhead, Pad Mounted, Dry Vault and Submersible Automatic Circuit Reclosers and Fault Interrupters for AC Systems
IEEE C37.63	(1997) Requirements for Overhead, Pad-Mounted, Dry-Vault, and Submersible Automatic Line Sectionalizer for AC Systems
IEEE C57.12.00	(1993) Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.13.2	(1991) IEEE Standard Conformance Test Procedures for Instrument Transformers
IEEE C57.15	(1986; R 1992) Requirements, Terminology, and Test Code for Step-Voltage and Induction-Voltage Regulators
IEEE C57.19.00	(1991; R 1997) IEEE Standard General Requirements and Test Procedures for Outdoor Power Apparatus Bushings
IEEE C57.19.01	(1991; R 1997) IEEE Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings
IEEE C57.98	(1993) Guide for Transformer Impulse Tests
IEEE C62.1	(1989; R 1994) Surge Arresters for AC Power Circuits
IEEE C62.2	(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems
IEEE C62.11	(1998) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits
IEEE Std 18	(1992) Shunt Power Capacitors
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 100	(1996) IEEE Standard Dictionary of Electrical and Electronics Terms

IEEE Std 242	(1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE Std 399	(1997) Recommended Practice for Industrial and Commercial Power Systems Analysis
IEEE Std 404	(1993; errata) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V Through 138 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V

INSULATED CABLE ENGINEERING ASSOCIATION (ICEA)

ICEA S-70-547	(1992) Weather Resistant Polyolefin Covered Wire & Cable
---------------	--

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA HV 2	(1991) Application Guide for Ceramic Suspension Insulators
NEMA ICS 6	(1993) Industrial Control and Systems, Enclosures
NEMA LA 1	(1992) Surge Arresters
NEMA SG 2	(1993) High Voltage Fuses
NEMA WC 5	(1992; Rev 1) Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 7	(1991; Rev 1) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	(1991; Rev 3 1996) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
---------	---------------------------------

RURAL UTILITIES SERVICES (RUS)

REA Bulletin 1728H-701	(1993) Crossarms (Solid and Laminated), Transmission Timbers and Pole Keys
------------------------	--

UNDERWRITERS LABORATORIES (UL)

- UL 467 (1993; Rev thru Aug 1996) Grounding and Bonding Equipment
- UL 486A (1997; Rev thru Dec 1998) Wire Connectors and Soldering Lugs for Use with Copper Conductors
- UL 486B (1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors

STATE OF CALIFORNIA (CA)

- CA G095 (March 1984) Rules For Overhead Electric Line Construction, General Order No. 95, Public Utilities Commission of the State of California

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Catalog; FIO.

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; FIO.

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include the item number, the quantity of items proposed, and the name of the manufacturer of the item.

Installation Procedures; FIO.

As a minimum, installation procedures for regulators, transformers and reclosers. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

SD-04 Drawings

Electrical Distribution System; FIO.

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams and other information necessary to define the

installation and enable the Government to check conformity with the requirements of the contract drawings. Detail drawings shall as a minimum include:

- a. Crossarms.
- b. Fused Cut Out.
- c. Conductors.
- d. Insulators.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall consist of the following:

- a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded.
- b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

SD-09 Reports

Test Reports; GFIO.

Three copies of the information described below in 8-1/2 by 11 inch binders having a minimum of 5 rings, and including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.

- e. The condition specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

SD-13 Certificates

Materials and Equipment; GA.

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided under this section of the specifications conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform thereto. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms thereto. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms thereto. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies.

SD-19 OPERATION AND MAINTENANCE MANUALS

Electrical Distribution System; GA.

Three copies of Operation and Maintenance manuals electrical distribution system shall be provided, within 7 calendar days following the completion of tests and shall include assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare-parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers. Three additional copies of the instructions manual shall be provided within 30 calendar days

following the manuals.

Three additional copies of the instructions manual within 30 calendar days following the approval of the manuals.

1.3 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements. Wood poles held in storage for more than 2 weeks shall be stored in accordance with ANSI O5.1. Handling of wood poles shall be in accordance with ANSI O5.1, except that pointed tools capable of producing indentations more than inch in depth shall not be used. Metal poles shall be handled and stored in accordance with the manufacturer's instructions.

1.4 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the Contracting Officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

Products shall conform to the following requirements. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.3 NAMEPLATES

2.3.1 General

Each major component shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Equipment containing liquid-dielectrics shall have the type of dielectric on the nameplate. Nameplates shall be made of noncorrosive metal. As a minimum, nameplates shall be provided for transformers, regulators, circuit breakers, capacitors, meters and switches.

2.4 CONDUCTORS, CONNECTORS, AND SPLICES

2.4.1 Aluminum-Composition Conductors

Aluminum-conductor-steel-reinforced, ACSR, shall comply with ASTM B 232.

2.4.2 Copper Conductors

Hard-drawn-copper conductors shall comply with ASTM B 1 and ASTM B 8 as appropriate for the conductor size.

2.4.3 Connectors and Splices

Connectors and splices shall be of copper alloys for copper conductors, aluminum alloys for aluminum-composition conductors, and a type designed to minimize galvanic corrosion for copper to aluminum-composition conductors. Aluminum-composition and aluminum-composition to copper shall comply with UL 486B, and copper-to-copper shall comply with UL 486A.

2.5 MEDIUM-VOLTAGE LINES

2.5.1 Bare Medium-Voltage Lines

Bare medium-voltage line conductors shall be aluminum-conductor-steel-reinforced, ACSR. Conductor types shall not be mixed on any project, unless specifically indicated. Conductors larger than No. 2 AWG shall be stranded.

2.6 CROSSARM ASSEMBLIES

2.6.1 Crossarms

Crossarms shall comply with REA Bulletin 1728H-701 and shall be solid wood, distribution type, except cross-sectional area with pressure treatment conforming to AWPAC 25, and a 1/4 inch, 45 degree chamfer on all top edges. Cross-sectional area minimum dimensions shall be 4-1/4 inches in height by 3-1/4 inches in depth in accordance with IEEE C2 for Grade B construction. Crossarms shall be 8 feet in length, except that 10 foot crossarms shall be used for crossarm-mounted banked single-phase transformers or elsewhere as indicated. Crossarms shall be machined, chamfered, trimmed, and bored for stud and bolt holes before pressure treatment. Factory drilling shall be provided for pole and brace mounting, for four pin or four vertical line-post insulators, and for four suspension insulators, except where otherwise indicated or required. Drilling shall provide required climbing space and wire clearances. Crossarms shall be straight and free of twists to within 1/10 inch per foot of length. Bend or twist shall be in one direction only.

2.7 FUSES AND SWITCHES, MEDIUM-VOLTAGE

2.7.1 Fuse Cutouts

Medium-voltage fuses and cutouts shall comply with NEMA SG 2 and shall be of the loadbreak open type construction rated 15 kV and of the normal-duty

type. Open-link cut-outs are not acceptable. Fuses shall be either indicating or dropout type. Fuse ratings shall be as indicated. Fuse cutouts shall be equipped with mounting brackets suitable for the indicated installations.

2.7.2 Fused Switches

Fused switches shall be single-pole, manual devices with integral power fuses of the dropout type. Fuse ratings shall be as indicated. Each switch shall have a continuous current rating of 400 amperes rms, a momentary asymmetrical current rating of 20 kA rms and shall be rated for the voltage of the system in which it is installed.

2.8 GROUNDING AND BONDING

2.8.1 Driven Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length of the sectional type driven full length into the earth.

2.8.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as the phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Circuits installed in conduits or underground and splices and terminations for medium-voltage cable shall conform to the requirements of Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Secondary circuits installed in conduit on poles shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of IEEE C2 for medium loading districts, Grade B construction. No reduction in clearance shall be made. The installation shall also comply with the applicable parts of NFPA 70 and CA G095.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall notify the Contracting Officer of any discrepancy before performing any work.

3.1.3 Disposal of Liquid Dielectrics

PCB-contaminated dielectric shall be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor shall furnish certification of proper disposal. Contaminated dielectric shall not be diluted to lower the level of contamination.

3.2 CROSSARM MOUNTING

Crossarms shall be bolted to poles with 5/8 inch through-bolts with square washers at each end. Bolts shall extend not less than 1/8 inch nor more than 2 inches beyond nuts. On single crossarm construction, the bolt head shall be installed on the crossarm side of the pole. Metal crossarm braces shall be provided on crossarms. Flat braces may be provided for 8 foot crossarms and shall be 1/4 by 1-1/4 inches, not less than 28 inches in length. Flat braces shall be bolted to arms with 3/8 inch carriage bolts with round or square washers between boltheads and crossarms, and secured to poles with 1/2 by 4 inch lag screws after crossarms are leveled and aligned. Angle braces are required for 10 foot crossarms and shall be 60 inch span by 18 inch drop formed in one piece from 1-1/2 by 1-1/2 by 3/16 inch angle. Angle braces shall be bolted to crossarms with 1/2 inch bolts with round or square washers between boltheads and crossarms, and secured to poles with 5/8 inch through-bolts. Double crossarms shall be securely held in position by means of 5/8 inch double-arming bolts. Each double-arming bolt shall be equipped with four nuts and four square washers.

3.2.1 Line Arms and Buck Arms

Line arms and buck arms shall be set at right angles to lines for straight runs and for angles 45 degrees and greater; and line arms shall bisect angles of turns of less than 45 degrees. Dead-end assemblies shall be used for turns where shown. Buckarms shall be installed, as shown, at corners and junction poles. Double crossarms shall be provided at ends of joint use or conflict sections, at dead-ends, and at angles and corners to provide adequate vertical and longitudinal strength. Double crossarms shall be provided at each line-crossing structure and where lines not attached to the same pole cross each other.

3.2.2 Equipment Arms

Equipment arms shall be set parallel or at right angles to lines as required to provide climbing space. Equipment arms shall be located below line construction to provide necessary wire and equipment clearances.

3.3 CONDUCTOR INSTALLATION

3.3.1 Line Conductors

Unless otherwise indicated, conductors shall be installed in accordance with manufacturer's approved tables of sags and tensions. Proper care shall be taken in handling and stringing conductors to avoid abrasions, sharp bends, cuts, kinks, or any possibility of damage to insulation or conductors. Conductors shall be paid out with the free end of conductors fixed and cable reels portable, except where terrain or obstructions make

this method unfeasible. Bend radius for any insulated conductor shall not be less than the applicable NEMA specification recommendation. Conductors shall not be drawn over rough or rocky ground, nor around sharp bends.

3.3.2 Connectors and Splices

Connectors and splices shall be mechanically and electrically secure under tension and shall be of the nonbolted compression type. The tensile strength of any splice shall be not less than the rated breaking strength of the conductor. Splice materials, sleeves, fittings, and connectors shall be noncorrosive and shall not adversely affect conductors. Aluminum-composition conductors shall be wire brushed and an oxide inhibitor applied before making a compression connection. Connectors which are factory-filled with an inhibitor are acceptable. Inhibitors and compression tools shall be of types recommended by the connector manufacturer. Primary line apparatus taps shall be by means of hot line clamps attached to compression type bail clamps (stirrups). Low-voltage connectors for copper conductors shall be of the solderless pressure type. Noninsulated connectors shall be smoothly taped to provide a waterproof insulation equivalent to the original insulation, when installed on insulated conductors. On overhead connections of aluminum and copper, the aluminum shall be installed above the copper.

3.4 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

Connections between aerial and underground systems shall be made as shown. Underground cables shall be extended up poles in guards and conduit to cable terminations. Conduits shall be secured to poles by conduit supports spaced not more than 10 feet apart and with one support not more than 12 inches from any bend or termination. Cables shall be supported by devices separate from the conduit or guard, near their point of exit from the riser conduit or guard. Cables guards shall be secured in accordance with the manufacturers published procedure. Risers shall be equipped with bushings to protect cables. Capnut potheads shall be used to terminate medium-voltage multiple-conductor cable.

3.5 GROUNDING

Noncurrent-carrying metal parts of equipment and conductor assemblies, such as luminaires, medium-voltage cable terminations and messengers, metal poles, operating mechanisms of pole top switches, panel enclosures, transformers, capacitors, recloser frames (cases) and other noncurrent-carrying metal items shall be grounded. Additional grounding of equipment, neutral, and surge arrester grounding systems shall be installed at poles where indicated.

3.5.1 Grounding Electrodes

Grounding electrodes shall be installed as follows:

- a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be located approximately 3 feet out from base of the pole and shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade. Multiple rods shall

be evenly spaced at least 10 feet apart and connected together 2 feet below grade with a minimum No. 6 bare copper conductor.

- b. Ground Resistance - The maximum resistance of a driven ground rod shall not exceed 25 ohms under normally dry conditions. Whenever the required ground resistance is not met, provide additional electrodes interconnected with grounding conductors, to achieve the specified ground resistance. The additional electrodes will be up to three, 10 foot rods spaced a minimum of 10 feet apart. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.5.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.5.3 Grounding Electrode Conductors

On multi-grounded circuits, as defined in IEEE C2, provide a single continuous vertical grounding electrode conductor. Neutrals, surge arresters, and equipment grounding conductors shall be bonded to this conductor. For single grounded or ungrounded systems, provide a grounding conductor for the surge arrester and equipment grounding conductors and a separate grounding conductor for the secondary neutrals. Grounding electrode conductors shall be sized as shown. Secondary system neutral conductors shall be connected directly to the transformer neutral bushings, then connected with a neutral bonding jumper between the transformer neutral bushing and the vertical grounding electrode conductor, as shown. Grounding electrode conductors shall be stapled to wood poles at intervals not exceeding 2 feet. On metal poles, a preformed galvanized steel strap, 5/8 inch wide by 22 gauge minimum by length, secured by a preformed locking method standard with the manufacturer, shall be used to support a grounding electrode conductor installation on the pole and spaced at intervals not exceeding 5 feet with one band not more than 3 inches from each end of the vertical grounding electrode conductor. Bends greater than 45 degrees in grounding electrode conductor are not permitted.

3.6 FIELD TESTING

3.6.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 5 days prior to conducting tests. The Contractor shall furnish materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform

tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results.

Field reports will be signed and dated by the Contractor.

3.6.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.6.3 Ground-Resistance Tests

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes shall be provided.

3.6.4 Pre-Energization Services

The following services shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to insure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings. Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage caused during installation or shipment and to ensure that packaging materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and tested in accordance with the instructions of the equipment manufacturer.

3.6.5 Operating Tests

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.7 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16375

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Terminology
- 1.3 SUBMITTALS
- 1.4 DELIVERY, STORAGE, AND HANDLING
- 1.5 EXTRA MATERIALS

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCT
- 2.2 NAMEPLATES
 - 2.2.1 General
 - 2.2.2 Liquid-Filled Transformer Nameplates
- 2.3 CORROSION PROTECTION
 - 2.3.1 Aluminum Materials
- 2.4 CABLES
 - 2.4.1 Medium-Voltage Cables
 - 2.4.1.1 General
 - 2.4.1.2 Ratings
 - 2.4.1.3 Conductor Material
 - 2.4.1.4 Insulation
 - 2.4.1.5 Shielding
 - 2.4.1.6 Jackets
 - 2.4.2 Low-Voltage Cables
 - 2.4.2.1 Conductor Material
 - 2.4.2.2 Insulation
 - 2.4.2.3 Jackets
 - 2.4.2.4 In Duct
- 2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS
 - 2.5.1 Medium-Voltage Cable Joints
 - 2.5.2 Medium-Voltage Separable Insulated Connectors
 - 2.5.3 Low-Voltage Cable Splices
 - 2.5.4 Terminations
 - 2.5.4.1 Factory Preformed Type
- 2.6 CONDUIT AND DUCTS
 - 2.6.1 Metallic Conduit
 - 2.6.2 Nonmetallic Ducts
 - 2.6.2.1 Concrete Encased Ducts
 - 2.6.3 Conduit Sealing Compound

- 2.7 MANHOLES, VAULTS, HANDHOLES, AND PULLBOXES
- 2.8 POLES AND HARDWARE
- 2.9 TRANSFORMERS
 - 2.9.1 Pad-Mounted Transformers
 - 2.9.1.1 High-Voltage Compartments
 - 2.9.1.2 Load-Break Switch
 - 2.9.1.3 Transformer Tank Sections
 - 2.9.1.4 Low-Voltage Cable Compartments
 - 2.9.1.5 Accessories
 - 2.9.2 Pad-Mounted Switch
 - 2.9.2.1 Ratings at 60 Hz shall be:
 - 2.9.2.2 Operators, Devices, and Controls
 - 2.9.2.3 Enclosures
- 2.10 GROUNDING AND BONDING
 - 2.10.1 Driven Ground Rods
 - 2.10.2 Grounding Conductors
- 2.11 CONCRETE AND REINFORCEMENT
- 2.12 LIQUID DIELECTRICS

PART 3 EXECUTION

- 3.1 GENERAL INSTALLATION REQUIREMENTS
 - 3.1.1 Conformance to Codes
 - 3.1.2 Verification of Dimensions
 - 3.1.3 Disposal of Liquid Dielectrics
- 3.2 CABLE AND BUSWAY INSTALLATION
 - 3.2.1 Cable Installation Plan and Procedure
 - 3.2.1.1 Cable Inspection
 - 3.2.1.2 Duct Cleaning
 - 3.2.1.3 Duct Lubrication
 - 3.2.1.4 Cable Installation
 - 3.2.2 Splices
 - 3.2.3 Electric Manholes and Vaults
- 3.3 CABLE JOINTS
- 3.4 DUCT BANKS
 - 3.4.1 Requirements
 - 3.4.2 Treatment
 - 3.4.3 Concrete Encasement
 - 3.4.4 Nonencased Direct-Burial
 - 3.4.5 Installation of Couplings
 - 3.4.5.1 Plastic Duct
- 3.5 MANHOLES, VAULTS, HANDHOLES, AND PULLBOXES
 - 3.5.1 General
 - 3.5.2 Electric Manholes and Vaults
 - 3.5.3 Communications Manholes and Vaults
 - 3.5.4 Handholes
 - 3.5.5 Pullboxes
 - 3.5.6 Ground Rods
- 3.6 PAD-MOUNTED EQUIPMENT INSTALLATION
 - 3.6.1 Concrete Pads
 - 3.6.1.1 Construction
 - 3.6.1.2 Concrete and Reinforcement
 - 3.6.1.3 Sealing
- 3.7 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

- 3.8 CONNECTIONS TO BUILDINGS
- 3.9 GROUNDING
 - 3.9.1 Grounding Electrodes
 - 3.9.2 Grounding and Bonding Connections
 - 3.9.3 Grounding and Bonding Conductors
 - 3.9.4 Surge Arrester Grounding
 - 3.9.5 Metal Splice Case Grounding
 - 3.9.6 Riser Pole Grounding
- 3.10 FIELD TESTING
 - 3.10.1 General
 - 3.10.2 Safety
 - 3.10.3 Ground-Resistance Tests
 - 3.10.4 Ground-Mat Connection Inspection
 - 3.10.5 Medium-Voltage Cable Test
 - 3.10.6 Low-Voltage Cable Test
 - 3.10.7 Liquid-Filled Transformer Tests
 - 3.10.8 Dry-Type Transformer Tests
 - 3.10.9 Circuit Breaker Tests
 - 3.10.10 Pre-Energization Services
 - 3.10.11 Operating Tests
- 3.11 MANUFACTURER'S FIELD SERVICE
 - 3.11.1 Onsite Training
 - 3.11.2 Installation Engineer
- 3.12 ACCEPTANCE

-- End of Section Table of Contents --

SECTION 16375

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.4	(1984; R 1996) Mechanical Demand Registers
ANSI C12.10	(1987) Electromechanical Watthour Meters
ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C29.1	(1988; R 1996) Electrical Power Insulators - Test Methods
ANSI C37.16	(1988; C37.16a; R 1995) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
ANSI C37.46	(1981; R 1992) Power Fuses and Fuse Disconnecting Switches
ANSI C37.50	(1989; R 1995) Switchgear, Low-Voltage AC Power Circuit Breakers Used in Enclosures - Test Procedures
ANSI C37.72	(1987) Manually-Operated Dead-Front, Padmounted Switchgear with Load-Interrupting Switches and Separable Connectors for Alternating-Current Systems
ANSI C37.121	(1989; R 1995) Switchgear, Unit Substations Requirements
ANSI C57.12.13	(1982) Conformance Requirements for Liquid-Filled Transformers Used in Unit

Installations, Including Unit Substations

ANSI C57.12.21	(1995) Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with High-Voltage Bushings; (High-Voltage, 34 500 Grd Y/19 920 Volts and Below; Low-Voltage, 240/120; 167 kVA and Smaller)
ANSI C57.12.26	(1993) Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVa and Smaller
ANSI C57.12.27	(1982) Conformance Requirements for Liquid-Filled Distribution Transformers Used in Pad-Mounted Installations, Including Unit Substations
ANSI C57.12.28	(1996) Switchgear and Transformers - Padmounted Equipment - Enclosure Integrity
ANSI C80.1	(1995) Rigid Steel Conduit - Zinc Coated
ANSI C119.1	(1986) Sealed Insulated Underground Connector Systems Rated 600 Volts
ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction
ANSI O5.1	(1992) Specifications and Dimensions for Wood Poles

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994a) Gray Iron Castings
ASTM A 123/A 123M	(1997a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(1995) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B 3	(1995) Soft or Annealed Copper Wire
ASTM B 8	(1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM B 231	(1995) Concentric-Lay-Stranded Aluminum 1350 Conductors

ASTM B 400	(1994) Compact Round Concentric-Lay-Stranded Aluminum 1350 Conductors
ASTM B 496	(1992) Compact Round Concentric-Lay-Stranded Copper Conductors
ASTM B 609	(1997) Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes
ASTM B 609M	(1991) Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes (Metric)
ASTM B 800	(1994) 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers
ASTM B 801	(1995) Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM D 923	(1991) Sampling Electrical Insulating Liquids
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2472	(1992) Sulfur Hexafluoride
ASTM D 4059	(1996) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5	(1994) Cross-linked Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV
AEIC CS6	(1996) Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 kV

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(1998) Approval Guide Fire Protection
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)	
IEEE C2	(1997) National Electrical Safety Code
IEEE ANSI/IEEE C37.1	(1994) IEEE Standard Definition, Specification, and Analysis of Systems Used for Supervisory Control, Data Acquisition, and Automatic Control
IEEE ANSI/IEEE C37.2	(1996) Electrical Power System Device Function Numbers and Contact Designations
IEEE ANSI/IEEE C37.13	(1990; R 1995) Low-Voltage AC Power Circuit Breakers Used in Enclosures
IEEE ANSI/IEEE C37.20.1	(1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
IEEE ANSI/IEEE C37.20.2	(1993; C37.20.2b) Metal-Clad and Station-Type Cubicle Switchgear
IEEE ANSI/IEEE C37.20.3	(1987; R 1992) Metal-Enclosed Interrupter Switchgear
IEEE ANSI/IEEE C37.23	(1987; R 1991) Guide for Metal-Enclosed Bus and Calculating Losses in Isolated-Phase Bus
IEEE ANSI/IEEE C37.30	(1997) Requirements for High-Voltage Switches
IEEE ANSI/IEEE C37.34	(1994) Test Code for High-Voltage Air Switches
IEEE ANSI/IEEE C37.41	(1994; C37.41e) Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories
IEEE ANSI/IEEE C37.63	(1997) Requirements for Overhead, Pad-Mounted, Dry-Vault, and Submersible Automatic Line Sectionalizer for AC Systems
IEEE ANSI/IEEE C37.90	(1989; R 1994) Relays and Relay Systems Associated with Electric Power Apparatus
IEEE ANSI/IEEE C37.90.1	(1989; R 1994) IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems
IEEE ANSI/IEEE C37.98	(1987; R 1990) Seismic Testing of Relays

IEEE ANSI/IEEE C57.12.00	(1993) IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE ANSI/IEEE C57.13	(1993) Instrument Transformers
IEEE ANSI/IEEE C57.98	(1993) Guide for Transformer Impulse Tests
IEEE C62.1	(1989; R 1994) Surge Arresters for AC Power Circuits
IEEE C62.2	(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems
IEEE C62.11	(1993) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits
IEEE Std 48	(1996) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 100	(1996) IEEE Standard Dictionary of Electrical and Electronics Terms
IEEE Std 242	(1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE Std 386	(1995) Separable Insulated Connector Systems for Power Distribution Systems Above 600V
IEEE Std 399	(1997) Recommended Practice for Industrial and Commercial Power Systems Analysis
IEEE Std 404	(1993; errata) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V through 138 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V
IEEE Std 592	(1990; R 1996) Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA BU 1	(1994) Busways
NEMA FB 1	(1993) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit and Cable Assemblies
NEMA FU 1	(1986) Low Voltage Cartridge Fuses
NEMA LA 1	(1992) Surge Arresters
NEMA PB 1	(1990) Panelboards
NEMA PB 2	(1995) Deadfront Distribution Switchboards
NEMA SG 2	(1993) High Voltage Fuses
NEMA SG 3	(1995) Power Switching Equipment
NEMA SG 5	(1990) Power Switchgear Assemblies
NEMA TC 5	(1990) Corrugated Polyolefin Coilable Plastic Utilities Duct
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA TC 7	(1990) Smooth-Wall Coilable Polyethylene Electrical Plastic Duct
NEMA WC 7	(1991; Rev 1) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	(1991; Rev 1; Rev 2) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
---------	---------------------------------

UNDERWRITERS LABORATORIES (UL)

UL 6	(1997) Rigid Metal Conduit
UL 198C	(1986; Rev thru Feb 1998) High-Interrupting-Capacity Fuses, Current-Limiting Types

UL 198D	(1995) Class K Fuses
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198H	(1988; Rev thru Nov 1993) Class T Fuses
UL 467	(1993; Rev thru Aug 1996) Grounding and Bonding Equipment
UL 486A	(1997) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors
UL 489	(1996; Rev thru Nov 1997) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 510	(1994; Rev thru Nov 1997) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(1996; Rev Jul 1998) Metallic Outlet Boxes
UL 651	(1995; Rev thru Oct 1998) Schedule 40 and 80 Rigid PVC Conduit
UL 854	(1996; Rev Apr 1998) Service-Entrance Cables
UL 857	(1994; Rev thru Nov 1996) Busways and Associated Fittings
UL 1072	(1995; Rev Mar 1998) Medium-Voltage Power Cable
UL 1242	(1996; Rev Apr 1997) Intermediate Metal Conduit
UL 1684	(1996) Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

STATE OF CALIFORNIA (CA)

CA G.O.95	(March 1984) Rules For Overhead Electric Line Construction, General Order No. 95, Public Utilities Commission of the State of California
CA G.O.128	(March 1984) Rules For Underground Electric Supply and Communication System, General Order No. 128, Public Utilities

Commission of the State of California

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Catalog Data; FIO.

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; FIO.

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

Installation Procedures; FIO.

As a minimum, installation procedures for transformers, substations, switchgear, and medium-voltage cable terminations and splices.

Procedures shall include cable pulling plans, diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

SD-04 Drawings

As-Built Drawings; FIO.

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of

each monthly pay estimate. Upon completion of the work, the Contractor shall provide three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within 10 calendar days from the time the drawings are returned to the Contractor.

SD-09 Reports

Field Testing; FIO.

A proposed field test plan, 20 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Test Reports; FIO.

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The condition specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

Cable Installation Reports; FIO.

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

- a. Site layout drawing with cable pulls numerically identified.
- b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.
- c. The cable manufacturer and type of cable.
- d. The dates of cable pulls, time of day, and ambient temperature.

- e. The length of cable pull and calculated cable pulling tensions.
- f. The actual cable pulling tensions encountered during pull.

SD-13 Certificates

Materials and Equipment; GA.

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

Cable Splicer Qualification; GA.

A certification that contains the names and the qualifications of people recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract. The certification shall indicate that any person recommended to perform actual splicing and terminations has been adequately trained in the proper techniques and have had at least three recent years of experience in splicing and terminating the same or similar types of cables approved for installation. In addition, any person recommended by the Contractor may be required to perform a practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage cables. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.

SD-19 OPERATION AND MAINTENANCE MANUALS

Electrical Distribution System; GA.

Six copies of operation and maintenance manuals, within 7 calendar days following the completion of tests and including assembly, installation,

operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked.

Three additional copies of the instructions manual shall be provided within 30 calendar days following the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements. Wood poles held in storage for more than 2 weeks shall be stored in accordance with ANSI O5.1. Handling of wood poles shall be in accordance with ANSI O5.1, except that pointed tools capable of producing indentations more than 1 inch in depth shall not be used. Metal poles shall be handled and stored in accordance with the manufacturer's instructions.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the contracting officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 NAMEPLATES

2.2.1 General

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal. Equipment containing liquid dielectrics shall have the type of dielectric on the nameplate. Sectionalizer switch nameplates shall have a schematic with all switch positions shown and labeled. As a minimum, nameplates shall be provided for transformers, circuit breakers, meters, switches, and switchgear.

2.2.2 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with nameplate information in accordance with IEEE ANSI/IEEE C57.12.00. Nameplates shall indicate the number of gallons and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is non-polychlorinated biphenyl. If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric is non-PCB classified, with less than 2 ppm PCB content in accordance with paragraph LIQUID DIELECTRICS. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 2 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

2.3 CORROSION PROTECTION

2.3.1 Aluminum Materials

Aluminum shall not be used.

2.4 CABLES

2.4.1 Medium-Voltage Cables

2.4.1.1 General

Cable construction shall be Type MV, conforming to NFPA 70 and UL 1072. Cables shall be manufactured for use in duct applications as indicated.

2.4.1.2 Ratings

Cables shall be rated for a circuit voltage 15 kV.

2.4.1.3 Conductor Material

Underground cables shall be soft drawn copper complying with ASTM B 3 and ASTM B 8 for regular concentric and compressed stranding or ASTM B 496 for compact stranding .

2.4.1.4 Insulation

Cable insulation shall be ethylene-propylene-rubber (EPR) insulation conforming to the requirements of NEMA WC 8 and AEIC CS6 . A 133 percent insulation level shall be used on 15 kV rated cables.

2.4.1.5 Shielding

Cables rated for 2 kV and above shall have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper tape shield for each phase. The shield tape shall be sized to meet IEEE C2 requirements for a ground fault availability of 20K amperes.

2.4.1.6 Jackets

Cables shall be provided with a PVC jacket. Direct buried cables shall be rated for direct burial.

2.4.2 Low-Voltage Cables

Cables shall be rated 600 volts and shall conform to the requirements of NFPA 70, and must be UL listed for the application or meet the applicable section of either ICEA or NEMA standards.

2.4.2.1 Conductor Material

Underground cables shall be annealed copper complying with ASTM B 3 and ASTM B 8 . Intermixing of copper and aluminum conductors is not permitted.

2.4.2.2 Insulation

Insulation must be in accordance with NFPA 70, and must be UL listed for the application or meet the applicable sections of either ICEA, or NEMA standards.

2.4.2.3 Jackets

Multiconductor cables shall have an overall PVC outer jacket.

2.4.2.4 In Duct

Cables shall be single-conductor cable, in accordance with NFPA 70 unless shown otherwise.

2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS

2.5.1 Medium-Voltage Cable Joints

Medium-voltage cable joints shall comply with IEEE Std 404 and IEEE Std 592.

Medium-voltage cable terminations shall comply with IEEE Std 48. Joints shall be the standard products of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts. Joints shall have ratings not less than the ratings of the cables on which they are installed. Splice kits may be of the heat-shrinkable type for voltages up to 15 kV, of the premolded splice and connector type. Joints used in manholes, handholes, vaults and pull boxes shall be certified by the manufacturer for waterproof, submersible applications.

2.5.2 Medium-Voltage Separable Insulated Connectors

Separable insulated connectors shall comply with IEEE Std 386 and IEEE Std 592 and shall be of suitable construction or standard splice kits shall be used. Separable insulated connectors are acceptable for voltages up to 35 kV. Connectors shall be of the loadbreak type as indicated, of suitable construction for the application and the type of cable connected, and shall include cable shield adaptors. Separable insulated connectors shall not be used as substitutes for conventional permanent splices. External clamping points and test points shall be provided.

2.5.3 Low-Voltage Cable Splices

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A and UL 486B.

Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

2.5.4 Terminations

Terminations shall be in accordance with IEEE Std 48, Class 1 or Class 2; of the molded elastomer, wet-process porcelain, prestretched elastomer, heat-shrinkable elastomer, or taped type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, and armor.

2.5.4.1 Factory Preformed Type

Molded elastomer, wet-process porcelain, prestretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level. Anti-tracking tape shall be applied over exposed insulation of preformed molded elastomer terminations.

2.6 CONDUIT AND DUCTS

Duct lines shall be concrete-encased, thin-wall type.

2.6.1 Metallic Conduit

Intermediate metal conduit shall comply with UL 1242. Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1. Epoxy coated rigid steel conduit and fittings shall comply with UL 514B

2.6.2 Nonmetallic Ducts

2.6.2.1 Concrete Encased Ducts

UL 651 Schedule 40 PVC unless shown otherwise.

2.6.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

2.7 MANHOLES, VAULTS, HANDHOLES, AND PULLBOXES

Manholes, vaults, handholes, and pullboxes shall be as indicated. Strength of manholes, handholes, and pullboxes and their frames and covers shall conform to the requirements of IEEE C2. Precast-concrete manholes shall have the required strength established by ASTM C 478, ASTM C 478M. Frames and covers shall be made of gray cast iron and a machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48, Class 30B, minimum. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be fabricated from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least and a flexural strength of at least. Pullbox and handhole covers in sidewalks, and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

2.8 POLES AND HARDWARE

Poles and hardware shall be in accordance with Section 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL.

2.9 TRANSFORMERS

2.9.1 Pad-Mounted Transformers

Pad-mounted transformers shall comply with ANSI C57.12.26 and shall be of the radial type. Pad-mounted transformer stations shall be assembled and coordinated by one manufacturer and each transformer station shall be shipped as a complete unit so that field installation requirements are limited to mounting each unit on a concrete pad and connecting it to primary and secondary lines. Stainless steel pins and hinges shall be provided. Barriers shall be provided between high- and low-voltage compartments. High-voltage compartment doors shall be interlocked with low-voltage compartment doors to prevent access to any high-voltage section unless its associated low-voltage section door has first been opened. Compartments shall be sized to meet the specific dimensional requirements

of ANSI C57.12.26. Pentahead locking bolts shall be provided with provisions for a padlock.

2.9.1.1 High-Voltage Compartments

The high-voltage compartment shall be dead-front construction. Primary switching and protective devices shall include loadbreak switching, oil-immersed, bayonet-type, overload fuse in series with a partial range current-limiting fuse, medium-voltage separable loadbreak connectors, universal bushing wells and inserts or integral one piece bushings and surge arresters. Fuses shall comply with the requirements of paragraph METERING AND PROTECTIVE DEVICES. The switch shall be mounted inside transformer tank with switch operating handle located in high-voltage compartment and equipped with metal loop for hook stick operation. Fuses shall be interlocked with switches so that fuses can be removed only when the associated switch is in the "OPEN" position. Adjacent to medium-voltage cable connections, a nameplate or equivalent stencilled inscription shall be provided inscribed "DO NOT OPEN CABLE CONNECTORS UNLESS SWITCH IS OPEN." Surge arresters shall be fully insulated and configured to terminate on the same bushing as the primary cable by means of a loadbreak, feed-through bushing insert .

2.9.1.2 Load-Break Switch

Radial-feed oil-immersed type rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 ampere, and a make-and-latch rating of 10,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment.

2.9.1.3 Transformer Tank Sections

Transformers shall comply with IEEE ANSI/IEEE C57.12.00, ANSI C57.12.21, and ANSI C57.12.26 and shall be of the mineral oil-insulated type . Transformers shall be suitable for outdoor use and shall have 2 separate windings per phase. Standard NEMA primary taps shall be provided. Where primary taps are not specified, 4, 2-1/2 percent rated kVA high-voltage taps shall be provided 2 above and 2 below rated, primary voltage. Operating handles for primary tap changers for de-energized operation shall be located within high-voltage compartments, externally to transformer tanks. Adjacent to the tap changer operating handle, a nameplate or equivalent stenciled inscription shall be provided and inscribed "DO NOT OPERATE UNDER LOAD." Transformer ratings at 60 Hz shall be as follows:

Three-phase capacity.....750 kVA.

Impedance.....5.75%.

Temperature Rise.....65 degrees C.

High-voltage winding.....12.47 K volts.

High-voltage winding connections.....15 kV.

Low-voltage winding.....480/277 Y volts.

Low-voltage winding connections..... 600 V.

2.9.1.4 Low-Voltage Cable Compartments

Neutrals shall be provided with fully-insulated bushings. Clamp type cable terminations, suitable for copper conductors entering from below, shall be provided as necessary.

2.9.1.5 Accessories

High-voltage warning signs shall be permanently attached to each side of padmounted equipment . Voltage warning signs shall comply with IEEE C2. Copper-faced steel or stainless steel ground connection pads shall be provided in both the high- and low-voltage compartments. Dial-type thermometer, liquid-level gauge, and drain valve with built-in sampling device shall be provided for each transformer station.

Insulated-bushing-type parking stands shall be provided adjacent to each separable load-break elbow to provide for cable isolation during sectionalizing operations.

2.9.2 Pad-Mounted Switch

The switch shall be configured with one incoming compartment for radial-feed, equipped with air-insulated, load-interrupter switches, as indicated. The outgoing compartments shall be provided with fused non-reclosing vacuum-type interrupters, as indicated.

2.9.2.1 Ratings at 60 Hz shall be:

Nominal voltage (kV).....12.

Rated maximum voltage (kV).....15.

Rated continuous current (A).....600.

Maximum symmetrical interrupting capacity (kA).....40.

Maximum asymmetrical interrupting capacity (kA).....40.

Three-second short-time current-carrying capacity (kA).....40.

BIL (kV).....95.

2.9.2.2 Operators, Devices, and Controls

Operators and controls shall be provided for the switchgear as follows:

- a. Switches shall be provided with a manual, handle-type operator or a push-button mechanical spring tripping mechanism, utilizing a stored-energy (spring-driven) mechanism to simultaneously open or close all phases. The switchgear shall be configured so that the switch actuator is padlockable, but may be accessed without

opening the switch compartment doors.

- b. Fused disconnects shall be hook-stick operated.
- c. Switches shall be provided with an automatic switch operator configured for local and remote opening and closing. Systems, components, and equipment shall conform to the requirements and recommendations of IEEE ANSI/IEEE C37.1.

2.9.2.3 Enclosures

Switch enclosures shall be of freestanding, self-supporting, vandal resistant, construction provided with separate incoming and outgoing compartments configured for bottom cable entry. Enclosures shall be of deadfront construction, provided with a hinged door for access to each compartment, and conform to the requirements of ANSI C57.12.28, ANSI C37.72, and IEEE ANSI/IEEE C37.20.3, Category A.

2.10 GROUNDING AND BONDING

2.10.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 not less than 5/8 inch in diameter by 10 feet in length. Sectional type rods may be used.

2.10.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.11 CONCRETE AND REINFORCEMENT

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete reinforcing shall be as specified in Section 03200 CONCRETE REINFORCEMENT.

2.12 LIQUID DIELECTRICS

Liquid dielectrics for transformers, capacitors, reclosers, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral-oil or less-flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than 50 parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 923 and have tests performed per ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 50 ppm shall be replaced.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions, CA G.O.95 and CA G.O.128. Circuits installed aerially shall conform to the requirements of Section 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of NFPA 70, IEEE C2, CA G.O.95 and CA G.O.128 as applicable.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

3.1.3 Disposal of Liquid Dielectrics

PCB-contaminated dielectrics must be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor shall furnish certification of proper disposal. Contaminated dielectrics shall not be diluted to lower the contamination level.

3.2 CABLE AND BUSWAY INSTALLATION

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, etc. The Contractor shall then prepare a checklist of significant requirements which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS.

3.2.1 Cable Installation Plan and Procedure

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

3.2.1.1 Cable Inspection

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

3.2.1.2 Duct Cleaning

Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is 1/4 inch less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of 2 times or until less than a volume of 8 cubic inches of debris is expelled from the duct.

3.2.1.3 Duct Lubrication

The cable lubricant shall be compatible with the cable jacket for cable that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

3.2.1.4 Cable Installation

The Contractor shall provide a cable feeding truck and a cable pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manilla rope followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct. For cable installation in cold weather, cables shall be kept at 50 degrees F temperature for at least 24 hours before installation.

3.2.2 Splices

Cable splices in low-voltage cables shall be made in manholes and handholes only, except as otherwise noted. Cable joints in medium-voltage cables shall be made in manholes or approved pullboxes only. Neutral and grounding conductors shall be installed in the same duct with their associated phase conductors.

3.2.3 Electric Manholes and Vaults

Cables shall be routed around the interior walls and securely supported from walls on cables racks. Cable routing shall minimize cable crossover, provide access space for maintenance and installation of additional cables, and maintain cable separation in accordance with IEEE C2.

3.3 CABLE JOINTS

Medium-voltage cable joints shall be made by qualified cable splicers only.

Qualifications of cable splicers shall be submitted in accordance with paragraph SUBMITTALS. Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint or in accordance with manufacturer's recommended practice. Cable joints shall provide insulation and jacket equivalent to that of the associated cable.

3.4 DUCT BANKS

3.4.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct banks shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in manholes, vault or handholes.

3.4.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.4.3 Concrete Encasement

Duct banks require concrete encasement. Ducts requiring concrete encasements shall comply with NFPA 70, except that electrical duct bank configurations for ducts 6 inches in diameter shall be determined by calculation and as shown on the drawings. The separation between adjacent electric power and communication ducts shall conform to IEEE C2. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point, except railroad and airfield crossings, tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70. At railroad and airfield crossings, duct lines shall be encased with concrete and reinforced as indicated to

withstand specified surface loadings. Tops of concrete encasements shall be not less than 5 feet below tops of rails or airfield paving unless otherwise indicated. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.

3.4.4 Nonencased Direct-Burial

Top of duct lines, which are not encased, shall be not less than 30 inches below finished grade and shall be installed with a minimum of 3 inches of earth around each duct, except that between adjacent electric power and communication ducts, 12 inches of earth is required. Bottoms of trenches shall be graded toward manholes, vaults or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least 6 inches. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers. Duct lines may be held in alignment with earth. However, high-tiered duct lines shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

3.4.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

3.4.5.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

3.5 MANHOLES, VAULTS, HANDHOLES, AND PULLBOXES

3.5.1 General

Manholes and vaults shall be constructed approximately where shown. The exact location of each manhole and vault shall be determined after careful consideration has been given to the location of other utilities, grading, and paving. The location of each manhole shall be approved by the Contracting Officer before construction of the manhole or a vault is

started. Manholes shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. The Contractor may at his option utilize monolithically constructed precast-concrete manholes having the required strength and inside dimensions as required by the drawings or specifications. In paved areas, frames and covers for manholes, vaults, and handholes entrances in vehicular traffic areas shall be flush with the finished surface of the paving. In unpaved areas, the top of manhole covers shall be approximately 1/2 inch above the finished grade. Where existing grades that are higher than finished grades are encountered, concrete assemblies designed for the purpose shall be installed to elevate temporarily the manhole cover to existing grade level. All duct lines entering manholes must be installed on compact soil or otherwise supported when entering a manhole to prevent shear stress on the duct at the point of entrance to the manhole or vault. Duct lines entering cast-in-place concrete manholes shall be cast in-place with the manhole. Duct lines entering precast concrete manholes through a precast knockout penetration shall be grouted tight with a portland cement mortar. PVC duct lines entering precast manholes through a PVC endbell shall be solvent welded to the endbell. A cast metal grille-type sump frame and cover shall be installed over the sump. A cable-pulling iron shall be installed in the wall opposite each duct line entrance.

3.5.2 Electric Manholes and Vaults

Cables shall be securely supported from walls by hot-dip galvanized cable racks with a plastic coating over the galvanizing and equipped with adjustable hooks and insulators. The number of cable racks indicated shall be installed in each manhole and not less than 2 spare hooks shall be installed on each cable rack. Insulators shall be made of high-glazed porcelain. Insulators will not be required on spare hooks.

3.5.3 Communications Manholes and Vaults

The number of hot-dip galvanized cable racks with a plastic coating over the galvanizing indicated shall be installed in each telephone manhole. Each cable rack shall be provided with 2 cable hooks. Cables for the telephone and communication systems will be installed by others.

3.5.4 Handholes

Handholes shall be located approximately as shown. Handholes shall be of the type noted on the drawings and shall be constructed in accordance with the details shown.

3.5.5 Pullboxes

Pullbox tops shall be flush with finished asphalt, concrete pad, sidewalks or curbs or placed 1/2 inch above surrounding grades when remote from curbed roadways or sidewalks. Covers shall be marked "Low-Voltage" and provided with 2 lifting eyes and 2 hold-down bolts. Each box shall have a suitable opening for a ground rod. Conduit, cable, ground rod entrances, and unused openings shall be sealed with mortar.

3.5.6 Ground Rods

A ground rod shall be installed at the manholes, handholes and pullboxes. Ground rods shall be driven into the earth before the manhole floor is poured so that approximately 4 inches of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.

3.6 PAD-MOUNTED EQUIPMENT INSTALLATION

Pad-mounted equipment, shall be installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of this document. Units shall be installed so that they do not damage equipment or scratch painted or coated surfaces. After installation, surfaces shall be inspected and scratches touched up with a paint or coating provided by the manufacturer especially for this purpose. Three-phase transformers shall be installed with ABC phase sequence. Primary taps shall be set at center.

3.6.1 Concrete Pads

3.6.1.1 Construction

Concrete pads for pad-mounted electrical equipment may be either pre-fabricated or poured-in-place. Pads shall be constructed as indicated, except that exact pad dimensions and mounting details are equipment specific and are the responsibility of the Contractor. Tops of concrete pads shall be level and shall project 4 inches above finished paving or grade and sloped to drain. Edges of concrete pads shall have 3/4 inch chamfer. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placement of concrete pads. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. To facilitate cable installation and termination, the concrete pad shall be provided with a rectangular hole below the primary and secondary compartments, sized in accordance with the manufacturer's recommended dimensions. Upon completion of equipment installation the rectangular hole shall be filled with masonry grout.

3.6.1.2 Concrete and Reinforcement

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete pad reinforcement shall be in accordance with Section 03200 CONCRETE REINFORCEMENT.

3.6.1.3 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing

compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.7 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

Connections between aerial and underground systems shall be made as shown. Underground cables shall be extended up poles in guards and conduit to cable terminations. Conduits shall be secured to the poles by 2-hole galvanized steel pipe straps spaced not more than 10 feet apart and with 1 strap not more than 12 inches from any bend or termination. Cable guards shall be secured to poles in accordance with the manufacturer's published procedures. Conduits shall be equipped with bushings to protect cables and minimize water entry. Capnut potheads shall be used to terminate medium-voltage multiple-conductor cable. Cables shall be supported by devices separate from the conduit or guard, near their point of exit from the conduit or guard.

3.8 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated, and shall be connected to the first applicable termination point in each building. Interfacing with building interior conduit systems shall be at conduit stubouts terminating 5 feet outside of a building and 3 feet below finished grade as specified and provided under Section 16415 ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed to prevent entrance of moisture or gases into buildings.

3.9 GROUNDING

A ground ring consisting of the indicated configuration of bare copper conductors and driven ground rods shall be installed around pad-mounted equipment as shown. Equipment frames of metal-enclosed equipment, and other noncurrent-carrying metal parts, such as cable shields, cable sheaths and armor, and metallic conduit shall be grounded. At least 2 connections shall be provided from a transformer, to the ground. Metallic frames and covers of handholes and pull boxes shall be grounded by use of a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.9.1 Grounding Electrodes

Grounding electrodes shall be installed as shown on the drawings and as follows:

- a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade.
- c. Ground ring - A ground ring shall be installed as shown consisting of bare copper conductors installed 18 inches, plus or minus 3 inches, below finished top of soil grade. Ground ring conductors shall be sized as shown.
- d. Additional electrodes - When the required ground resistance is not

met, additional electrodes shall be provided interconnected with grounding conductors to achieve the specified ground resistance. The additional electrodes will be up to three, 10 foot rods spaced a minimum of 10 feet apart. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

3.9.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.9.3 Grounding and Bonding Conductors

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.9.4 Surge Arrester Grounding

Surge arresters and neutrals shall be bonded directly to the transformer enclosure and then to the grounding electrode system with a bare copper conductor, sized as shown. Lead lengths shall be kept as short as practicable with no kinks or sharp bends.

3.9.5 Metal Splice Case Grounding

Metal splice cases for medium-voltage direct-burial cable shall be grounded by connection to a driven ground rod located within 2 feet of each splice box using a grounding electrode conductor having a current-carrying capacity of at least 20 percent of the individual phase conductors in the associated splice box, but not less than No. 6 AWG.

3.9.6 Riser Pole Grounding

A single continuous vertical grounding electrode conductor shall be installed on each riser pole and connected directly to the grounding electrodes indicated on the drawings or required by these specifications. All equipment, neutrals, surge arresters, and items required to be grounded shall be connected directly to this vertical conductor. The grounding electrode conductor shall be sized as shown. Grounding electrode conductors shall be stapled to wood poles at intervals not exceeding 2 feet.

3.10 FIELD TESTING

3.10.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 5 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field test reports shall be signed and dated by the Contractor.

3.10.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.10.3 Ground-Resistance Tests

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.
- b. Multiple rod electrodes - 25 ohms.
- c. Ground mat - 25 ohms.
- d. Ground ring - 25 ohms.

3.10.4 Ground-Mat Connection Inspection

All below-grade ground-mat connections will be visually inspected by the Contracting Officer before backfilling. The Contractor shall notify the Contracting Officer 24 hours before the site is ready for inspection.

3.10.5 Medium-Voltage Cable Test

After installation and before the operating test or connection to an existing system, the medium-voltage cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase

conductor of the system by connecting conductors as one terminal and connecting grounds or metallic shieldings or sheaths of the cable as the other terminal for each test. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment. The test shall be conducted with all splices, connectors, and terminations in place. The method, voltage, length of time, and other characteristics of the test for initial installation shall be in accordance with NEMA WC 7 or NEMA WC 8 for the particular type of cable installed, except that 28 kV and 35 kV insulation test voltages shall be in accordance with either AEIC CS5 or AEIC CS6 as applicable, and shall not exceed the recommendations of IEEE Std 404 for cable joints and IEEE Std 48 for cable terminations unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed. Repaired or replaced cables shall be retested.

3.10.6 Low-Voltage Cable Test

Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

$$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 1000 / (\text{length of cable in feet})$$

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

3.10.7 Liquid-Filled Transformer Tests

The following field tests shall be performed on all liquid-filled transformers. Pass-fail criteria shall be in accordance with transformer manufacturer's specifications.

- a. Insulation resistance test phase-to-ground.
- b. Turns ratio test.
- c. Correct phase sequence.
- d. Correct operation of tap changer.

3.10.8 Dry-Type Transformer Tests

The following field tests shall be performed on all dry-type transformers. Pass-fail criteria shall be in accordance with the transformer

manufacturer's specifications.

- a. Insulation resistance test phase-to-ground.
- b. Turns ratio test.

3.10.9 Circuit Breaker Tests

The following field tests shall be performed on circuit breakers. Pass-fail criteria shall be in accordance with the circuit breaker manufacturer's specifications.

- a. Insulation resistance test phase-to-phase.
- b. Insulation resistance test phase-to-ground.
- c. Closed breaker contact resistance test.
- d. Power factor test.
- e. High-potential test.
- f. Manual and electrical operation of the breaker.

3.10.10 Pre-Energization Services

Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of 2 years of current product experience. The following services shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to ensure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings. Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage caused during installation or shipment to ensure packaging materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and tested in accordance with the instructions of the equipment manufacturer. Items for which such services shall be provided, but are not limited to, are the following:

- a. Pad-mounted transformers
- b. Switchboards

3.10.11 Operating Tests

After the installation is completed, and at such times as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.11 MANUFACTURER'S FIELD SERVICE

3.11.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, and servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations.

3.11.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of the equipment, assist in the performance of the onsite tests, initial operation, and instruct personnel as to the operational and maintenance features of the equipment.

3.12 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16403

MOTOR CONTROL CENTERS, SWITCHBOARDS AND PANELBOARDS

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 Rules
 - 1.2.2 Coordination
 - 1.2.3 Standard Products
 - 1.2.4 Nameplates
- 1.3 SUBMITTALS
- 1.4 DELIVERY, STORAGE, AND HANDLING
- 1.5 MAINTENANCE
 - 1.5.1 Accessories and Tools
 - 1.5.2 Spare Parts

PART 2 PRODUCTS

- 2.1 CONNECTIONS
- 2.2 MOLDED CASE CIRCUIT BREAKERS
 - 2.2.1 Trip Units
 - 2.2.2 480-Volt AC Circuits
 - 2.2.3 120/240-Volt AC Circuits
 - 2.2.4 Main Service Disconnect
 - 2.2.5 Utility Metering Sections
 - 2.2.6 Power Monitor
 - 2.2.6.1 Current Transformers for Kwh and Demand Metering (Low-Voltage)
 - 2.2.6.2 Voltage Transformers
 - 2.2.6.3 Watthour Meters
 - 2.2.6.4 Surge Arresters
- 2.3 WIRING
- 2.4 TERMINAL BLOCKS
 - 2.4.1 Types of Terminal Blocks
 - 2.4.1.1 Short-Circuiting Type
 - 2.4.1.2 Load Type
 - 2.4.2 Marking Strips
- 2.5 MOTOR CONTROL CENTERS
 - 2.5.1 Enclosures
 - 2.5.1.1 Unit Compartments
 - 2.5.1.2 Motor Control Center Doors and Covers
 - 2.5.1.3 Horizontal Wireways
 - 2.5.1.4 Vertical Wireways

- 2.5.1.5 Sills
- 2.5.1.6 Shutters
- 2.5.2 Buses
 - 2.5.2.1 Horizontal Bus
 - 2.5.2.2 Vertical Bus
 - 2.5.2.3 Ground Bus
 - 2.5.2.4 Neutral Bus
- 2.5.3 Combination Starters
 - 2.5.3.1 Magnetic Contactors
 - 2.5.3.2 Reduced Voltage Starters
 - 2.5.3.3 Auxiliary Contacts
 - 2.5.3.4 Overload Relays
 - 2.5.3.5 Individual Control Transformers
 - 2.5.3.6 Voltage Fault Protection
- 2.5.4 Molded Case Circuit Breakers in Unit Compartments
- 2.5.5 Panelboards for Motor Control Centers
- 2.5.6 Distribution Transformers
- 2.5.7 Wiring for Motor Control Centers
 - 2.5.7.1 Contractor's Wiring
 - 2.5.7.2 External Connections
 - 2.5.7.3 Terminal Blocks
- 2.5.8 Accessories and Control Devices
 - 2.5.8.1 Control Stations
 - 2.5.8.2 LED Indicating Lights
 - 2.5.8.3 Control Relays
 - 2.5.8.4 Timing Relays
 - 2.5.8.5 Elapsed-Time Meters
- 2.5.9 Feeder Tap Units
- 2.5.10 Metering Section
 - 2.5.10.1 Instrument Transformers
- 2.6 SWITCHBOARDS
 - 2.6.1 Enclosure
 - 2.6.2 Bus
 - 2.6.3 Grounding Bus
 - 2.6.4 Components
- 2.7 PANELBOARDS
 - 2.7.1 Enclosure
 - 2.7.2 Buses
 - 2.7.3 Components
- 2.8 PAINTING
- 2.9 FACTORY TESTS
 - 2.9.1 Motor Control Centers Tests
 - 2.9.1.1 Dielectric Tests
 - 2.9.1.2 Operational Tests
 - 2.9.1.3 Short Circuit Tests
 - 2.9.2 Switchboards Tests
 - 2.9.2.1 Production Tests
 - 2.9.3 Panelboards Tests

PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 16403

MOTOR CONTROL CENTERS, SWITCHBOARDS AND PANELBOARDS
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 187	(1994) Copper Bar, Bus Bar, Rod and Shapes
ASTM B 317	(1992a) Aluminum-Alloy Extruded Bar, Rod, Tube, Pipe, and Structural Shapes for Electrical Purposes (Bus Conductor)

ASME INTERNATIONAL (ASME)

ASME B1.1	(1989) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C12.1	(1988) Code for Electricity Metering
IEEE C12.4	(1984; R 1990) Mechanical Demand Registers
IEEE C12.10	(1987) Electromechanical Watthour Meters
IEEE C12.11	(1987) Instrument Transformers for Revenue Metering, 10 kV BIL Through 350 kV (0.6 kV NSV Through 69 kV NSV)
IEEE C57.13	(1993) Instrument Transformers

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA ICS 1	(1993) Industrial Control and Systems
NEMA ICS 2	(1993) Industrial Control Devices,

Controllers and Assemblies

NEMA ICS 4	(1993) Industrial Control and Systems Terminal Blocks
NEMA ICS 6	(1993) Industrial Control and Systems Enclosures
NEMA PB 1	(1990) Panelboards
NEMA PB 2	(1989) Deadfront Distribution Switchboards
NEMA ST 1	(1988) Specialty Transformers (Except General Purpose Type)
NEMA ST 20	(1992) Dry-Type Transformers for General Applications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
---------	---------------------------------

UNDERWRITERS LABORATORIES (UL)

UL 44	(1991; Rev thru Jan 1995) Rubber-Insulated Wires and Cables
UL 50	(1992) Enclosures for Electrical Equipment
UL 67	(1993; Rev thru May 1994) Panelboards
UL 489	(1991; Rev thru Dec 1994) Molded Case Circuit Breakers and Circuit Breaker Enclosures
UL 845	(1995) Motor Control Centers
UL 891	(1994; Rev thru Jan 1995) Dead-Front Switchboards
UL 1063	(1993; Rev thru Oct 1994) Machine-Tool Wires and Cables

1.2 SYSTEM DESCRIPTION

These specifications include the design, fabrication, assembly, wiring, testing, and delivery of the items of equipment and accessories and spare parts listed in the Schedule and shown on the drawings.

1.2.1 Rules

The equipment shall conform to the requirements of NFPA 70 unless more stringent requirements are indicated herein or shown. NEMA rated and UL listed equipment has been specified when available. Equipment must meet

NEMA and UL construction and rating requirements as specified. No equivalent will be acceptable. The contractor shall immediately notify the Contracting Officer of any requirements of the specifications or contractor proposed materials or assemblies that do not comply with UL or NEMA. International Electrotechnical Commission (IEC) rated equipment will not be considered an acceptable alternative to specified NEMA ratings.

1.2.2 Coordination

The general arrangement of the motor control centers, switchboards and panelboards is shown on the contract drawings. Any modifications of the equipment arrangement or device requirements as shown on the drawings shall be subject to the approval of the Contracting Officer. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. All equipment shall be completely assembled at the factory. The motor control centers and switchboards may be disassembled into sections, if necessary, for convenience of handling, shipping, and installation.

1.2.3 Standard Products

Material and equipment shall be standard products of a manufacturer regularly engaged in their manufacture and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. All materials shall conform to the requirements of these specifications. Materials shall be of high quality, free from defects and imperfections, of recent manufacture, and of the classification and grades designated. All materials, supplies, and articles not manufactured by the Contractor shall be the products of other recognized reputable manufacturers. If the Contractor desires for any reason to deviate from the standards designated in these specifications, he shall, after award, submit a statement of the exact nature of the deviation, and shall submit, for the approval of the Contracting Officer, complete specifications for the materials which he proposes to use.

1.2.4 Nameplates

Nameplates shall be made of laminated sheet plastic or of anodized aluminum approximately 4 millimeters (1/8 inch) thick, engraved to provide white letters on a black background. The nameplates shall be fastened to the panels in proper positions with anodized round-head screws. Lettering shall be minimum 15 millimeters (1/2 inch) high. Nameplate designations shall be in accordance with lists on the drawings, and as a minimum shall be provided for the following equipment:

- a. Motor Control Centers
- b. Individual items of equipment mounted in the Motor Control Centers
- c. Switchboards
- d. Individually-mounted circuit breakers in Switchboard
- e. Group-mounted circuit breakers in Switchboard

f. Panelboards

g. Dedicated receptacles

Equipment of the withdrawal type shall be provided with nameplates mounted on the removable equipment in locations visible when the equipment is in place.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; FIO.

The Contractor shall within 30 calendar days after date of award submit for approval six (6) copies of such descriptive cuts and information as are required to demonstrate fully that all parts of the equipment will conform to the requirements and intent of the specifications. Data shall include descriptive data showing typical construction of the types of equipment proposed, including the manufacturer's name, type of molded case circuit breakers or motor circuit protectors, performance capacities and other information pertaining to the equipment. Six (6) sets of characteristic curves of the individual breaker trip element shall be submitted.

SD-04 Drawings

Outline Drawings; FIO.

The Contractor shall, within 30 calendar days after date of award, submit for the approval of the Contracting Officer six (6) copies of outline drawings of all equipment to be furnished under this contract, together with weights and overall dimensions. Drawings shall show the general arrangement and overall dimensions of the motor control centers, switchboards, and panelboards. These drawings shall show space requirements, details of any floor supports to be embedded in concrete and provisions for conduits for external cables.

Motor Control Center; FIO.

The Contractor shall, within 30 calendar days after date of award, submit for the approval of the Contracting Officer six (6) copies of electrical equipment drawings. The NEMA Class II motor control center drawings shall include a connection diagram with wire designations and schematic diagrams to illustrate operation of associated motor unit controls. An individual wiring diagram for each motor control center shall be submitted. A single-line diagram, equipment list and nameplate schedule shall be provided for each motor control center.

Switchboards; FIO. Panelboards; FIO.

The Contractor shall, within 30 calendar days after date of award , submit for the approval of the Contracting Officer six (6) copies of electrical equipment drawings. A single-line diagram, equipment list and nameplate schedule shall be provided for each switchboard and panelboard.

SD-08 Statements

Factory Tests; FIO.

The Contractor shall submit, within a minimum of 14 days prior to the proposed date of tests, six (6) copies of manufacturer's routine factory test procedures and production line tests for all motor control centers and switchboards.

SD-09 Reports

Factory Tests; FIO.

The Contractor shall submit six (6) complete reproducible copies of the factory inspection results and six (6) complete reproducible copies of the factory test results in booklet form, including all plotted data curves, all test conditions, a listing of test equipment complete with calibration certifications, and all measurements taken. Report shall be signed and dated by the Contractor's and Contracting Officer's Representatives.

1.4 DELIVERY, STORAGE, AND HANDLING

The equipment shall be shipped as completely assembled and wired as feasible so as to require a minimum of installation work. Each shipping section shall be properly match marked to facilitate reassembly, and shall be provided with removable lifting channels with eye bolts for attachment of crane slings to facilitate lifting and handling. Any relay or other device which cannot withstand the hazards of shipment when mounted in place on the equipment shall be carefully packed and shipped separately. These devices shall be marked with the number of the panel which they are to be mounted on and fully identified. All finished painted surfaces and metal work shall be wrapped suitably or otherwise protected from damage during shipment. All parts shall be prepared for shipment so that slings for handling may be attached readily while the parts are in a railway car or transport truck. Sections of equipment crated for shipment shall be of such size, including crates, that they will pass through a doubledoor. All spare parts and accessories shall be carefully packaged and clearly marked.

1.5 MAINTENANCE

1.5.1 Accessories and Tools

A complete set of accessories and special tools unique to equipment provided and required for erecting, handling, dismantling, testing and maintaining the apparatus shall be furnished by the Contractor.

1.5.2 Spare Parts

Spare parts shall be furnished as specified below. All spare parts shall be of the same material and workmanship, shall meet the same requirements, and shall be interchangeable with the corresponding original parts furnished.

- a. 2 - Fuses of each type and size.
- b. 1 - Circuit breaker auxiliary switch.
- c. 2 - Operating coils for each size ac contactor.
- d. 1 - Operating coil for each size dc contactor.
- e. 2 - Complete sets of 3-pole stationary and moving contact assemblies for each size ac contactor.
- f. 1 - Complete set of 2-pole stationary and moving contact assemblies for each size dc contactor.
- g. 3 - Contactor overload relays of each type and rating, each relay with a complete set of contact blocks.
- h. 1 - spare set of heater elements for each heater rating provided.
- i. 2 - Indicating lamp assemblies of each type.
- j. 1 - Control transformer of each type and rating.
- k. 1 - Control relay of each type and rating.
- l. 1 - Contactor auxiliary contact of each type.
- m. 4 - One quart containers of finish paint for indoor equipment.

PART 2 PRODUCTS

2.1 CONNECTIONS

All bolts, studs, machine screws, nuts, and tapped holes shall be in accordance with ASME B1.1. The sizes and threads of all conduit and fittings, tubing and fittings, and connecting equipment shall be in accordance with ASME B1.20.1. All ferrous fasteners shall have rust-resistant finish and all bolts and screws shall be equipped with approved locking devices. Manufacturer's standard threads and construction may be used on small items which, in the opinion of the Contracting Officer, are integrally replaceable, except that threads for external connections to these items shall meet the above requirements.

2.2 MOLDED CASE CIRCUIT BREAKERS

Molded case circuit breakers shall conform to the applicable requirements of NEMA AB 1 and UL 489. The circuit breakers shall be manually-operated, shall be quick-make, quick-break, common trip type, and shall be of

automatic-trip type unless otherwise specified or indicated on the drawings. All poles of each breaker shall be operated simultaneously by means of a common handle. The operating handles shall clearly indicate whether the breakers are in "On," "Off," or "Tripped" position and shall have provisions for padlocking in the "Off" position. Personnel safety line terminal shields shall be provided for each breaker. The circuit breakers shall be products of only one manufacturer, and shall be interchangeable when of the same frame size.

2.2.1 Trip Units

Except as otherwise noted, the circuit breakers, of frame sizes and the trip unit ratings as shown on the drawings, shall be provided with combination thermal and instantaneous magnetic or solid state trip units. The Government reserves the right to change the indicated trip ratings, within frame limits, of the trip devices at the time the shop drawings are submitted for approval. The breaker trip units shall be interchangeable and the instantaneous magnetic trip units shall be adjustable on frame sizes larger than 150 amperes. Nonadjustable instantaneous magnetic trip units shall be set at approximately 10 times the continuous current ratings of the circuit breakers. Solid state trip units, where indicated, shall also have adjustable long time pick-up and delay, short time pick-up and delay, and ground fault pick-up and delay.

2.2.2 480-Volt AC Circuits

Circuit breakers for 480-volt or 277/480-volt ac circuits shall be rated 600 volts ac, and shall have an UL listed minimum interrupting capacity of 65,000 symmetrical amperes at 600 volts ac.

2.2.3 120/240-Volt AC Circuits

Circuit breakers for 120-volt ac circuits shall be rated not less than 120/240 or 240 volts ac, and shall have a UL listed minimum interrupting capacity of 10,000 symmetrical amperes.

2.2.4 Main Service Disconnect

The main service disconnect shall be a 1200 amp frame molded case circuit breaker with solid state trip unit, adjustable trip settings and integral ground fault protection. Initially set the long time trip at 600 amps. The breaker shall be rated for 65KAIC.

2.2.5 Utility Metering Sections

Provide utility metering sections which meets PG&E/USERC Requirements. In addition, provide current transformers, digital watt-hour meter socket and wiring which meets the base's requirements.

2.2.6 Power Monitor

Provide a power monitor having the features and functions specified below. The power monitor shall consist of microprocessor-based unit. The power monitor shall be UL recognized and meet ANSI Standard C37.90.

<u>Metered Values (Accuracy)</u>	<u>Protective Functions</u>
AC Phase Amperes (1%)	Voltage Phase Loss (less than 50% RMS)
AC Phase Voltage (1%)	Current Phase Loss (1/16 largest phase)
Watts (2%)	Phase Voltage Unbalance (5 to 40% in 5% steps)
Vars (2%)	Phase Voltage Reversal
Power Factor (4%)	Overvoltage (105 to 140% - 5% steps)
Frequency (0.5%)	Undervoltage (95 to 60% - 5% steps)
Watt-hours (2%)	Time Delay for Overvoltage, Undervoltage,
Watt Demand (2%)	and Phase Unbalance (0 to 8 sec.)

2.2.6.1 Current Transformers for Kwh and Demand Metering (Low-Voltage)

Current transformers shall conform to IEEE ANSI/IEEE C57.13. Provide current transformers with a metering accuracy Class of 0.3 through B-0.5, with a minimum RF of 2.0 at 30 degrees C, with 600-volt insulations, and 10 kV BIL. Provide butyl-molded, window-type current transformers mounted in the current transformer cabinet.

2.2.6.2 Voltage Transformers

Voltage transformers shall have indicated ratios. Units shall have an accuracy class rating of 1.2. Voltage transformers shall be of the drawout type having current-limiting fuses in both primary and secondary circuits. Mechanical interlocks shall prevent removal of fuses, unless the associated voltage transformer is in a drawout position. Voltage transformer compartments shall have hinged doors.

2.2.6.3 Watthour Meters

Watthour meters shall conform to ANSI C12.10, except numbered terminal wiring sequence and case size may be the manufacturer's standard. Watthour meters shall be of the socket mounted indoor type having a 15 minute, cumulative form, demand register meeting ANSI C12.4 and provided with not less than 2-1/2 staters.

2.2.6.4 Surge Arresters

Surge arresters shall comply with NEMA LA 1, IEEE C62.1, IEEE C62.2, and IEEE C62.11 and shall be provided where indicated. Arresters shall be distribution class 480 V, 3 phase, 4 wire. Arresters shall be equipped with mounting brackets suitable for the indicated installations. Arresters shall be of the combination valve-metal-oxide varistor type.

2.3 WIRING

All control wire shall be stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44 or Type MTW meeting UL 1063, and shall pass the VW-1 flame tests included in those standards. Hinge wire shall have Class K stranding. Current transformer secondary leads shall be not smaller than No. 10 AWG. The minimum size of control wire shall be No. 14 AWG. Power wiring for 480-volt circuits and below shall be of the same type as control wiring and the minimum size

shall be No. 12 AWG. Special attention shall be given to wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

2.4 TERMINAL BLOCKS

Control circuit terminal blocks for control wiring shall be molded or fabricated type with barriers, rated not less than 600 volts. The terminals shall be removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts. The terminals shall be not less than No. 10 in size and shall have sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal. The terminal arrangement shall be subject to the approval of the Contracting Officer and not less than four (4) spare terminals or 10 percent, whichever is greater, shall be provided on each block or group of blocks. Modular, pull apart, terminal blocks will be acceptable provided they are of the channel or rail-mounted type. The Contractor shall submit data showing that the proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.4.1 Types of Terminal Blocks

2.4.1.1 Short-Circuiting Type

Short-circuiting type terminal blocks shall be furnished for all current transformer secondary leads and shall have provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks shall meet the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.

2.4.1.2 Load Type

Load terminal blocks rated not less than 600 volts and of adequate capacity shall be provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits except those for feeder tap units.

The terminals shall be of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, screws shall have hexagonal heads. Conducting parts between connected terminals shall have adequate contact surface and cross-section to operate without overheating. Each connected terminal shall have the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.4.2 Marking Strips

White or other light-colored plastic marking strips, fastened by screws to each terminal block, shall be provided for wire designations. The wire numbers shall be made with permanent ink. The marking strips shall be reversible to permit marking both sides, or two marking strips shall be furnished with each block. Marking strips shall accommodate the two sets of wire numbers. Each device to which a connection is made shall be

assigned a device designation in accordance with NEMA ICS 1 and each device terminal to which a connection is made shall be marked with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, additional wire and cable designations for identification of remote (external) circuits shall be provided for the Government's wire designations. Prints of drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

2.5 MOTOR CONTROL CENTERS

Each motor control center shall be designed for operation on 480-volts ac, 3-phase, 60-Hz system, and the equipment shall conform to all the applicable requirements of NEMA ICS 1, NEMA ICS 2, NEMA ICS 4 and NEMA ICS 6.

Vertical sections and individual units shall be listed and labeled under UL 845 where ever possible. In lieu of the UL listing, certification from any nationally recognized, adequately equipped, testing agency that the individual units and vertical sections have been tested and conform to the UL requirements of that agency will be acceptable when approved by the Contracting Officer. The motor control center shall be NEMA Class II, Type B, motor control centers in accordance with NEMA ICS 2.

2.5.1 Enclosures

Each motor control center shall consist of the required number of vertical sections of 2250 millimeters (90 inches) nominal height, bolted together, with steel channel sills and suitable for mounting against a wall. Vertical section shall be 510 millimeters (20 inches) deep and buses, control wiring, control transformers, small power transformers, terminal blocks, line terminals, cable supports, and clamps shall be accessible from the front. Enclosure shall be NEMA Type 1 gasketed. The control centers shall be fabricated from smooth select steel sheets shaped and reinforced to form rigid free-standing structures. Metal thickness for enclosures shall be not less than specified in NEMA ICS 6 without exception. Vertical edges of sections exposed to view shall be so fabricated and bolted that the joints will not pass a 1.6 millimeter (1/16 inch) gage. Each structure shall be designed for addition of future sections required. Individual compartments shall be isolated from adjacent compartments.

2.5.1.1 Unit Compartments

Each operating unit shall contain equipment as shown on the drawings, mounted in an individual cell. The unit assembly, except main circuit breakers, panelboards and auxiliary control devices, shall be drawout type removed from the front, without rear access or disturbing other units in the control center assembly. All drawout type unit assemblies shall have positive guide rail system to ensure alignment of connection to vertical bus. Units shall be mechanically interlocked with the door to prevent removal while in the energized position. Each removable unit shall have provision for padlocking in a position in which it is disconnected from the

vertical bus although not removed from the stationary structure. All ventilating openings shall be provided with corrosion-resistant insect-proof screens on the inside. Bus closing plugs shall be provided for all unused openings in vertical bus barriers.

2.5.1.2 Motor Control Center Doors and Covers

Each unit compartment, including blank compartments for future use, shall be provided with either a flange-formed or a rolled-edge door. Each door shall be mounted on fully-concealed or continuous full-length piano-type hinges and shall be provided with positive fasteners. Door sag shall be prevented by proper alignment of hinges made of sufficiently strong material. The door fastenings shall be so interlocked to prevent opening when the equipment is energized. The external operating handle shall clearly indicate whether the equipment is in an "ON", "OFF" or "TRIPPED" position.

2.5.1.3 Horizontal Wireways

Structure shall have a top and a bottom horizontal wireway. Both horizontal wireways shall run the length of the structure. Cover plates shall be provided on the side of the assembly to permit extension of the horizontal bus and wireway when vertical sections are added.

2.5.1.4 Vertical Wireways

Vertical wireways shall be provided in all vertical sections accepting multiple plug-in components. Vertical wireways shall connect with horizontal wireways at the top and bottom and be a minimum 100 millimeters (4 inches) wide. Barriers shall be provided in sections containing both ac and dc vertical buses. Doors shall be provided on each vertical wireway. The exposed surface of any door shall not deviate more than 1.5 millimeters (1/16-inch) from a true plane.

2.5.1.5 Sills

Channel iron foundations, complete with bolts and drilled holes for grouting and anchoring to the floor, shall be furnished for the complete length (front and rear) of each motor control center assembly. The channels shall be designed for flat mounting and maximum channel depth shall be 60 millimeters (2-1/2 inches). Additional channel or substantial metal trim shall be provided flush with the end panels to completely enclose the bases across the ends of the equipment assemblies.

2.5.1.6 Shutters

Drawout units shall have shutters which close when the unit is withdrawn to isolate the vertical bus.

2.5.2 Buses

All buses shall be of copper and all bolted splices and connections between buses and for extensions or taps for equipment shall be tin or silver-plated. Copper bars and shapes for bus conductors shall conform to the applicable

requirements of ASTM B 187. All splices for field assembly shall be bolted with at least two bolts and shall employ the use of "Belleville" washers in the connection. The bus ratings shall be based on a 65 degree Celsius maximum temperature rise in accordance with UL 845 requirements. Bus shall have a short-circuit current rating of not less than 65,000 RMS symmetrical amperes. All bus work shall be supported on wet process porcelain insulators, glass polyester, or suitable molded material.

2.5.2.1 Horizontal Bus

Each control center assembly shall be provided with a three-phase main horizontal bus, with a continuous current rating not less than 800 amperes, located across the top of each vertical section. The ends of horizontal buses shall be drilled for future extensions.

2.5.2.2 Vertical Bus

Each vertical section shall be provided with a three-phase vertical bus with a continuous current rating of 300 amperes connected to the horizontal bus by brazing, welding, or bolting. Where the incoming feeder breakers are located at the bottom of a control center, the vertical bus in that section shall be rated the same as the main horizontal bus. Vertical buses shall extend from the horizontal bus to the bottom of the lowest available unit mounting space. The vertical bus shall be isolated from wireways and equipment in compartments.

2.5.2.3 Ground Bus

A copper ground bus shall be provided full width at the bottom of the motor control center line-up. A full clamp-type solderless copper or copper alloy lug for No. 2/0 AWG stranded copper cable shall be provided at each end of the bus for connection to the station grounding system.

2.5.2.4 Neutral Bus

A half rated neutral bus shall be furnished continuous through the control center. Lugs of appropriate capacity will be furnished.

2.5.3 Combination Starters

Combination motor controller units shall contain motor circuit protectors or molded-case circuit breakers, auxiliary and pilot devices and a magnetic contactor with thermal overload relays or reduced voltage starter or variable frequency drive where indicated on the drawings. The ratings of motor circuit protectors, molded case circuit breakers, contactors, motor controllers and other devices shall be as shown on the drawings. All combination motor controller units shall have short circuit ratings equal to 65KAIC or greater. Where control push-buttons, indicating lamps, "Hand-Off-Automatic" switches, and similar control devices are associated with a unit, they shall be mounted on the unit compartment door. Door-mounted components shall not interfere with access within the compartments. Molded case circuit breakers for use in combination starters shall meet the requirements of paragraph MOLDED CASE CIRCUIT BREAKERS. Motor circuit protectors shall be only part of the combination starters as

required by NFPA 70 and shall conform to all requirements of paragraph MOLDED CASE CIRCUIT BREAKERS, except that trip units shall have provision for locking the selected trip setting.

2.5.3.1 Magnetic Contactors

Magnetic contactors shall be of the NEMA sizes indicated on the drawings. The rating, performance and service characteristics shall conform to the requirements of NEMA ICS 2 for contactors with continuous current ratings for the duty indicated. Contactors for motor control shall be rated for full-voltage starting (Class A controllers). Contactors shall be suitable for at least 200,000 complete operations under rated load without more than routine maintenance. The interruption arc and flame shall be minimized by suitable arc chutes or other means so that no damage will be done to other portions of the device. The arc chutes, if provided, shall be easily removable without removing or dismantling other parts. The contacts shall be easily removable. All current-carrying contact surfaces shall be silver-surfaced or of other approved material to prevent the formation of high resistance oxides. The contactor shall operate without chatter or perceptible hum while energized. Coils shall be suitable for continuous operation 120-volt ac circuits. Alternating-current contactors shall be three-pole, except where otherwise noted, and shall be insulated for 600 volts ac and of the electrically-operated, magnetically-held type. Direct-current contactors shall be two-pole, suitable for controlling circuits operating at 125 volts dc, insulated for 250 volts dc, electrically-operated, magnetically-held type and adequate for full-voltage motor starting service.

2.5.3.2 Reduced Voltage Starters

Solid State soft-start starters shall be three phase SCR controlled for stepless reduced voltage starting of induction motors. Current transformers shall provide feedback signal to regulate torque during start up and to prevent overload conditions while motor is running. Starter shall have starting current of 300 percent of full load amps for thirty seconds, bypass/isolation contactor, and three phase thermal overload relay.

2.5.3.3 Auxiliary Contacts

Each controller shall be provided with a minimum of three auxiliary contacts which can be easily changed from normally open to normally closed. Where indicated on the drawings, a fourth auxiliary contact and red and green indicating lights shall be provided.

2.5.3.4 Overload Relays

Except as otherwise indicated, each controller shall be provided three NEMA Class 20 thermal overload relays with external manual reset. Prior to shipment of the control centers, the Contracting Officer will furnish the ratings of the heater elements to be installed in the relays by the Contractor.

2.5.3.5 Individual Control Transformers

Where 120 volt ac control of contactors is indicated or required, individual control transformer shall be provided on the line side of the unit disconnect. The control transformers shall be rated 480-120 volts and shall conform to the requirements for control transformers in NEMA ST 1. Control transformers shall have adequate volt-ampere capacity for the control functions indicated. Transformers shall be installed with primary fuses. Except as otherwise indicated on the drawings, each control transformer shall be provided with a fuse in one secondary lead and shall have the other secondary lead grounded.

2.5.3.6 Voltage Fault Protection

Where shown, starters shall be provided with protection against voltage faults, phase loss, phase reversal, undervoltage and overvoltage. Upon sensing one of these faults, the protector shall de-energize the starter. The protector shall use a combination of voltage and phase-angle sensing to detect phase loss even when regenerated voltages are present. The protector shall be connected to the load side of the motor circuit disconnect. The protector shall have an adjustable line voltage trip level, adjustable trip delay, automatic reset and Single Pole Double Throw (SPDT) output contacts. Protector operation shall have repeatability of +1 percent of set point, maximum, and a dead band of 2 percent maximum. Protector shall have green indicator to show normal status and red indicator to show tripped status.

2.5.4 Molded Case Circuit Breakers in Unit Compartments

Molded case circuit breakers for installation in unit compartments shall meet the requirements of paragraph MOLDED CASE CIRCUIT BREAKERS above.

2.5.5 Panelboards for Motor Control Centers

Panelboards shall meet the requirements of paragraph PANELBOARDS.

2.5.6 Distribution Transformers

Dry type transformers for power and lighting loads shall be furnished with voltage and kVA ratings as indicated on the drawings. The transformers shall conform to the requirements for general-purpose transformers in NEMA ST 20. Each transformer shall be protected on the primary side with a molded case circuit breaker as indicated on the drawings.

2.5.7 Wiring for Motor Control Centers

All wiring shall meet the requirements of paragraph WIRING above. Heavy-duty clamp type terminals shall be provided by the Contractor for terminating all power cables entering the control centers.

2.5.7.1 Contractor's Wiring

The Contractor's wiring shall be formed into groups, suitably bound together, properly supported and run straight horizontally or vertically. There shall be no splices in the wiring. The manufacturer's standard pressure-type wire terminations for connections to internal devices will be

acceptable. Terminal blocks shall be added for wiring to devices having leads instead of terminals. Ring tongue indented terminals shall be used on all wires terminated on control terminal blocks for external or interpanel connections and at shipping splits. All stud terminals shall have contact nuts and either locking nuts or lockwashers.

2.5.7.2 External Connections

In general, power and control cables will enter the control centers at the bottom.

2.5.7.3 Terminal Blocks

Terminal blocks shall meet the requirements of paragraph TERMINAL BLOCKS above. In no case shall the terminals provided for circuit breakers or contactors accommodate less than the number or size of conductors shown on the drawings. Special attention shall be given to wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

2.5.8 Accessories and Control Devices

Control accessories shall be provided, and shall be suitable for mounting on the front of, or inside, the control centers as indicated on the drawings. Control accessories shall meet the applicable requirements of NEMA ICS 2. Relays and other equipment shall be so mounted that mechanical vibration will not cause false operation.

2.5.8.1 Control Stations

Push-button stations and selector switches shall conform to NEMA ICS 2, shall be of the heavy-duty, oil-tight type, rated 600 volts ac, and have a contact rating designation of A600. Switches shall be provided with escutcheon plates clearly marked to show operating positions.

2.5.8.2 LED Indicating Lights

Red and green LED's shall be furnished where shown on the drawings, indicating contact "open" and "closed" position. The LED's shall be accessible and replaceable from the front of the control center through a finished opening in the compartment door. The LED assemblies shall be of the heavy duty oiltight, watertight, and dusttight type.

2.5.8.3 Control Relays

Control relays shall be of the electrically operated, magnetically held, self-reset, open type, suitable for mounting inside the starter compartments, and shall be 120-volt ac. Contacts shall be as indicated on the drawings and shall have a contact rating designation of A600 or N600, as required, in accordance with NEMA ICS 2.

2.5.8.4 Timing Relays

Timers shall be pneumatic type. They shall be suitable for mounting inside

the control center and shall be rated 120 volts ac, 60 Hz. Instantaneous and time delay contacts shall be provided as indicated on the drawings, and shall have a contact rating designation of A600 or N600, as required, in accordance with NEMA ICS 2. Means shall be provided for manual adjustment over a range as indicated on the drawings.

2.5.8.5 Elapsed-Time Meters

Hour-indicating time meters shall have 6- digit registers with counter numbers at least 7 millimeters (1/4 inch) high. White numbers on black backgrounds shall provide hour indication with the last digit in contrasting colors to indicate tenths of an hour. The enclosure shall be 90 millimeters (3-1/2 inches) square and dust resistant. Operating voltage shall be 120 volts ac. They shall be of the nonreset type.

2.5.9 Feeder Tap Units

Feeder tap units shall be provided as indicated on the drawings.

2.5.10 Metering Section

Metering section shall be provided with instruments as indicated on the drawings.

2.5.10.1 Instrument Transformers

All transformers used for metering shall meet the requirements of IEEE C12.11 and IEEE C57.13. Voltage transformers shall be protected with removable primary and secondary fuses. Fuses shall be installed in each ungrounded lead and located adjacent to the transformers in an easily accessible place. If cable connections to current transformer primary are required, terminals of an approved solderless type and proper size shall be furnished. If current transformers are connected to buses, proper connections shall be furnished, complete with bolts, nuts, washers and other accessories.

2.6 SWITCHBOARDS

The switchboards shall be dead-front switchboards conforming to NEMA PB 2 and labeled under UL 891. The switchboards shall be completely enclosed self-supporting metal structures with the required number of vertical panel sections, buses, molded-case circuit breakers, and other devices as shown on the drawings. Switchboards shall be fully rated for a short-circuit current of 65,000 symmetrical amperes RMS AC.

2.6.1 Enclosure

Each switchboard enclosure shall be NEMA type 1, built with selected smooth sheet steel panels of not less than 1.9 millimeters (No. 14 gage). Exposed panels on the front and ends shall have bent angle or channel edges with all corner seams welded and ground smooth. The front outside surfaces shall not be drilled or welded for the purpose of attaching wires or mounting devices if such holes or fastenings will be visible from the front. The front panels shall be made in sections flanged on four sides

and attached to the framework by screws and arranged for ready removal for inspection or maintenance. Rear access to the bus and device connections shall not be required to service equipment. Ventilating openings shall be provided as required and shall preferably be of the grille type. All ventilating openings shall be provided with corrosion-resistant insect-proof screens on the inside. Each switchboard shall be provided with a channel iron base at front, rear, and sides, with exposed ends covered by welded steel plates. Grout holes shall be provided. The switchboard sections shall be bolted to the base. All interior and exterior steel parts shall be treated to inhibit corrosion and shall be painted as specified in paragraph PAINTING.

2.6.2 Bus

All buses shall be of copper and all bolted splices and connections between buses and for extensions or taps for equipment shall be tin or silver-plated throughout. Copper bars and shapes for bus conductors shall conform to the applicable requirements of ASTM B 187. All splices for field assembly shall be bolted with at least two bolts and shall employ the use of "Belleville" washers in the connection. Horizontal and vertical power buses have minimum current ratings as shown on the drawings. The buses shall be insulated for not less than 600 volts. Shop splices and tap connections shall be brazed, pressure-welded or bolted. All splices for field assembly shall be bolted. The buses shall be mounted on insulating supports of wet process porcelain, glass polyester, or suitable molded material, and shall be braced to withstand not less than 65,000 symmetrical amperes ac.

2.6.3 Grounding Bus

A copper ground bus, rated not less than 300 amps, extending the entire length of the assembled structure, shall be mounted near the bottom of enclosure. A full clamp-type solderless copper or copper alloy lug for No. 2/0 AWG stranded copper cable shall be provided at each end of the bus for connection to the station grounding system.

2.6.4 Components

Each switchboard shall be equipped with molded-case circuit breakers conforming to paragraph MOLDED CASE CIRCUIT BREAKERS and with frame sizes, trip ratings, and terminal connectors for attachment of outgoing power cables as shown on the drawings. The circuit breakers shall be individually stationary mounted, as shown on the drawings, and shall be operable and removable from the front. Where shown on the drawings, circuit breakers shall be enclosed in individual compartments. The group-mounted circuit breakers shall be provided complete with bus work in an integrated assembly on the switchboard and shall conform to the applicable requirements of paragraph PANELBOARDS.

2.7 PANELBOARDS

Panelboards shall consist of assemblies of molded-case circuit breakers with buses and terminal lugs for the control and protection of branch circuits to motors, heating devices and other equipment operating at 480

volts ac or less. Panelboards shall be UL 67 labeled. "Loadcenter" type panels are not acceptable. Panelboards shall be designed for installation in surface-mounted or flush-mounted cabinets accessible from the front only, as shown on the drawings. Panelboards shall be fully rated for a short-circuit current of 10,000 symmetrical amperes RMS ac minimum.

2.7.1 Enclosure

Enclosures shall meet the requirements of UL 50. All cabinets shall be fabricated from sheet steel of not less than 3.5 millimeters (No. 10 gage) if flush-mounted or mounted outdoors, and not less than 2.7 millimeters (No. 12 gage) if surface-mounted indoors, with full seam-welded box ends. Cabinets mounted outdoors or flush-mounted shall be hot-dipped galvanized after fabrication. Cabinets shall be painted in accordance with paragraph PAINTING. Front edges of cabinets shall be form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front. All cabinets shall be so fabricated that no part of any surface on the finished cabinet shall deviate from a true plane by more than 3 millimeters (1/8 inch). Holes shall be provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 15 millimeter (1/2 inch) clear space between the back of the cabinet and the wall surface. Flush doors shall be mounted on hinges that expose only the hinge roll to view when the door is closed. Each door shall be fitted with a combined catch and lock, except that doors over 600 millimeters (24 inches) long shall be provided with a three-point latch having a knob with a T-handle, and a cylinder lock. Two keys shall be provided with each lock, and all locks shall be keyed alike. Finished-head cap screws shall be provided for mounting the panelboard fronts on the cabinets. Enclosure shall have nameplates in accordance with paragraph NAMEPLATES. Directory holders, containing a neatly typed or printed directory under a transparent cover, shall be provided on the inside of panelboard doors.

2.7.2 Buses

All panelboards shall be of the dead-front type with buses and circuit breakers mounted on a plate or base for installation as a unit in a cabinet. All buses shall be of copper and shall be tin or silver-plated throughout. Copper bars and shapes for bus conductors shall conform to the applicable requirements of ASTM B 187. The sizes of buses and the details of panelboard construction shall meet or exceed the requirements of NEMA PB 1. Suitable provisions shall be made for mounting the bus within panelboards and adjusting their positions in the cabinets. Terminal lugs required to accommodate the conductor sizes shown on the drawing, shall be provided for all branch circuits larger than No. 10 AWG. A grounding lug suitable for 1/0 AWG wire shall be provided for each panelboard.

2.7.3 Components

Each branch circuit, and the main buses where so specified or shown on the drawings, shall be equipped with molded-case circuit breakers having overcurrent trip ratings as shown on the drawings. The circuit breakers shall be of a type designed for bolted connection to buses in a panelboard assembly, and shall meet the requirements of paragraph MOLDED CASE CIRCUIT

BREAKERS. Circuit breakers of the same frame size and rating shall be interchangeable.

2.8 PAINTING

Interior and exterior steel surfaces of equipment enclosures shall be thoroughly cleaned and then receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces shall be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces shall receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice. Exterior surfaces shall be primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish. Equipment located indoors shall be ANSI Light Gray. All touch-up work shall be done with manufacturer's coatings as supplied under paragraph SPARE PARTS.

2.9 FACTORY TESTS

Each item of equipment supplied under this contract shall be given the manufacturer's routine factory tests and tests as specified below, to insure successful operation of all parts of the assemblies. All tests required herein shall be witnessed by the Contracting Officer unless waived in writing, and no equipment shall be shipped until it has been approved for shipment by the Contracting Officer. The Contractor shall notify the Contracting Officer a minimum of 14 days prior to the proposed date of the tests so that arrangements can be made for the Contracting Officer to be present at the tests. The factory test equipment and the test methods used shall conform to the applicable NEMA Standards, and shall be subject to the approval of the Contracting Officer. Reports of all witnessed tests shall be signed by witnessing representatives of the Contractor and Contracting Officer. The cost of performing all tests shall be borne by the Contractor and shall be included in the prices bid in the schedule for equipment.

2.9.1 Motor Control Centers Tests

2.9.1.1 Dielectric Tests

Each motor control center shall be completely assembled and given dielectric tests in accordance with NEMA ICS 1.

2.9.1.2 Operational Tests

The correctness of operation of each circuit breaker, motor circuit protector, magnetic contactor and of all control devices, accessories and indicating lamps, shall be checked. These checks shall be made at rated voltage with power supplies to the main buses. All magnetic contactors shall also be checked for proper operation with power at 90 percent of rated voltage.

2.9.1.3 Short Circuit Tests

If the unit is not UL labeled for the specified short circuit, the contractor may submit design tests demonstrating that satisfactory

short-circuit tests, as specified in NEMA ICS 2, have been made on a motor control center of similar type of construction and having the same available short circuit current at the motor terminals, including any motor contributions, as the motor control centers specified to be furnished under these specifications.

2.9.2 Switchboards Tests

2.9.2.1 Production Tests

Each switchboard shall be completely assembled and given applicable production tests for assembled switchgear as specified in NEMA PB 2.

2.9.3 Panelboards Tests

Each panelboard shall be assembled with cabinet and front to the extent necessary to check the fit and provisions for installing all parts in the field. Each panelboard shall be given a dielectric test in accordance with NEMA PB 1. All circuit breakers shall be operated to check mechanical adjustments. All doors and locks shall be checked for door clearances and fits and the performance of lock and latches.

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16410

AUTOMATIC TRANSFER SWITCH

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Standard Product
 - 1.2.2 Nameplate
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 AUTOMATIC TRANSFER SWITCH (ATS)
 - 2.1.1 Override Time Delay
 - 2.1.2 Transfer Time Delay
 - 2.1.3 Return Time Delay
 - 2.1.4 Engine Shutdown Time Delay
 - 2.1.5 Exerciser
 - 2.1.6 Auxiliary Contacts
 - 2.1.7 Supplemental Features
 - 2.1.8 Operator
 - 2.1.9 Override Switch
 - 2.1.10 Green Indicating Light
 - 2.1.11 Red Indicating Light
- 2.2 ENCLOSURE
 - 2.2.1 Construction
 - 2.2.2 Cleaning and Painting
- 2.3 TESTING
 - 2.3.1 Factory Testing
 - 2.3.2 Factory Test Reports

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 INSTRUCTIONS
- 3.3 SITE TESTING

-- End of Section Table of Contents --

SECTION 16410

AUTOMATIC TRANSFER SWITCH
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117 (1997) Operating Salt Spray (Fog) Apparatus

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.13 (1990; R 1995) Low-Voltage AC Power
Circuit Breakers Used in Enclosures

IEEE C37.90.1 (1989; R 1991) IEEE Standard Surge
Withstanding Capability (SWC) Tests for
Protective Relays and Relay Systems

IEEE C62.41 (1991; R 1995) Surge Voltages in
Low-Voltage AC Power Circuits

IEEE Std 602 (1996) Recommended Practices for Electric
Systems in Health Care Facilities

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1 (1993) Industrial Controls and Systems

NEMA ICS 2 (1993) Industrial Control Devices,
Controllers and Assemblies

NEMA ICS 4 (1993) Industrial Control and Systems
Terminal Blocks

NEMA ICS 6 (1993) Industrial Control and Systems,
Enclosures

NEMA ICS 10 (1993) Industrial Control and Systems: AC
Transfer Switch Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
NFPA 110	(1999) Emergency and Standby Power Systems
UNDERWRITERS LABORATORIES (UL)	
UL 1008	(1996; Rev Sep 1997) Transfer Switch Equipment
UL 1066	(1997) Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Product

Material and equipment shall be standard products of a manufacturer regularly engaged in manufacturing the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. The experience use shall include applications in similar circumstances and of same design and rating as specified ATS. Equipment shall be capable of being serviced by a manufacturer-authorized and trained organization that is, in the Contracting Officer's opinion, reasonably convenient to the site.

1.2.2 Nameplate

Nameplate showing manufacturer's name and equipment ratings shall be made of corrosion-resistant material with not less than 1/8 inch tall characters. Nameplate shall be mounted to front of enclosure and shall comply with nameplate requirements of NEMA ICS 2.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Switches; FIO.

Schematic, external connection, one-line schematic and wiring diagram of each ATS assembly. Interface equipment connection diagram showing conduit and wiring between ATS and related equipment. Device, nameplate, and item numbers shown in list of equipment and material shall appear on drawings wherever that item appears. Diagrams shall show interlocking provisions and cautionary notes, if any. Operating instructions shall be shown either on one-line diagram or separately. Unless otherwise approved, one-line and elementary or schematic diagrams shall appear on same drawing.

SD-07 Schedules

Material, Equipment, and Fixture Lists; FIO.

List of proposed equipment and material, containing a description of each separate item.

SD-09 Reports

Tests; FIO.

A description of proposed field test procedures, including proposed date and steps describing each test, its duration and expected results, not less than 2 weeks prior to test date.

Certified factory and field test reports, within 14 days following completion of tests. Reports shall be certified and dated and shall demonstrate that tests were successfully completed prior to shipment of equipment.

SD-13 Certificates

Equipment and Materials; FIO.

Certificates of compliance showing evidence of UL listing and conformance with applicable NEMA standards. Such certificates are not required if manufacturer's published data, submitted and approved, reflect UL listing or conformance with applicable NEMA standards.

Switching Equipment; FIO.

Evidence that ATS withstand current rating (WCR) has been coordinated with upstream protective devices as required by UL 1008. Upon request, manufacturer shall also provide notarized letter certifying compliance with requirements of this specification, including withstand current rating.

SD-19 Operation and Maintenance Manuals

Manuals; FIO.

Six copies of operating manual outlining step-by-step procedures for system startup, operation, and shutdown. Manual shall include manufacturer's name, model number, service manual, parts list, and brief description of equipment and basic operating features. Manufacturer's spare parts data shall be included with supply source and current cost of recommended spare parts. Six copies of maintenance manual listing routine maintenance, possible breakdowns, repairs, and troubleshooting guide. Manual shall include simplified wiring and control diagrams for system as installed.

PART 2 PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH (ATS)

ATS shall be electrically operated and mechanically held in both operating positions. ATS shall be suitable for use in standby systems described in NFPA 70. ATS shall be UL listed. ATS shall be manufactured and tested in

accordance with applicable requirements of IEEE C37.90.1, IEEE C37.13, IEEE C62.41, IEEE Std 602, NEMA ICS 1, NEMA ICS 2, NEMA ICS 10, UL 1008 and UL 1066. ATS shall conform to NFPA 110. To facilitate maintenance, manufacturer's instruction manual shall provide typical maximum contact voltage drop readings under specified conditions for use during periodic maintenance. Manufacturer shall provide instructions for determination of contact integrity. ATS shall be rated for continuous duty at specified continuous current rating. ATS shall have the following characteristics:

- a. Voltage: 480/277 volts ac.
- b. Number of Phases: Three.
- c. Number of Wires: Four.
- d. Frequency: 60 Hz.
- e. Poles: Three switched.
- f. ATS WCR: Rated to withstand short-circuit current of 65,000 amperes, RMS symmetrical.
- g. Nonwelding Contacts: Rated for nonwelding of contacts when used with upstream feeder overcurrent devices shown and with available fault current specified.
- h. Main Contacts: Contacts shall have silver alloy composition.

2.1.1.1 Override Time Delay

Time delay to override monitored source deviation shall be adjustable from 0.5 to 6 seconds and factory set at 1 second. ATS shall monitor phase conductors to detect and respond to sustained voltage drop of 25 percent of nominal between any two preferred source conductors and initiate transfer action to alternate source and start engine driven generator after set time period. Pickup voltage shall be adjustable from 85 to 100 percent of nominal and factory set at 90 percent. Dropout voltage shall be adjustable from 75 to 98 percent of pickup value and factory set at 85 percent of nominal.

2.1.1.2 Transfer Time Delay

Time delay before transfer to alternate power source shall be adjustable from 0 to 5 minutes and factory set at 0 minutes. ATS shall monitor frequency and voltage of alternate power source and transfer when frequency and voltage are stabilized. Pickup voltage shall be adjustable from 85 to 100 percent of nominal and factory set at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal and factory set at 90 percent.

2.1.1.3 Return Time Delay

Time delay before return transfer to preferred power source shall be adjustable from 0 to 30 minutes and factory set at 30 minutes. Time delay

shall be automatically defeated upon loss or sustained undervoltage of alternate power source, provided that preferred supply has been restored.

2.1.4 Engine Shutdown Time Delay

Time delay shall be adjustable from 0 to 30 minutes and shall be factory set at 10 minutes.

2.1.5 Exerciser

Provide a generator exerciser timer. Run times shall be user programmable.

The generator exerciser shall be selectable between load transfer and engineer run only, and shall have a fail-safe feature that will retransfer the ATS to preferred during the exercise period.

2.1.6 Auxiliary Contacts

Two normally open and two normally closed auxiliary contacts rated at 10 amperes at 120 volts shall operate when ATS is connected to preferred power source, and two normally open and two normally closed contacts shall operate when ATS is connected to alternate source.

2.1.7 Supplemental Features

ATS shall be furnished with the following:

- a. Engine start contact.
- b. Alternate source monitor.
- c. Test switch to simulate normal power outage.
- d. Voltage sensing. Pickup voltage adjustable from 85 to 100 percent of nominal; dropout adjustable from 75 to 98 percent of pickup.
- e. Time delay bypass switch to override return time delay to normal.
- f. Manual return-to-normal switch.
- g. Means shall be provided in the ATS to insure that motor/transformer load inrush currents do not exceed normal starting currents. This shall be accomplished with either in-phase monitoring, time-delay transition, or load voltage decay sensing methods. If manufacturer supplies an in-phase monitoring system, the manufacturer shall indicate under what conditions a transfer cannot be accomplished. If the manufacturer supplies a time-delay transition system, the manufacturer shall supply recommendations for establishing time delay. If load voltage decay sensing is supplied, the load voltage setting shall be user programmable.

2.1.8 Operator

Manual operator conforming to UL 1008 shall be provided, and shall

incorporate features to prevent operation by unauthorized personnel. ATS shall be designed for safe manual operation under full load conditions. If manual operation is accomplished by opening the door, then a dead-front shall be supplied for operator safety.

2.1.9 Override Switch

Override switch shall bypass automatic transfer controls so ATS will transfer and remain connected to alternate power source, regardless of condition of preferred source. If alternate source fails and preferred source is available, ATS shall automatically retransfer to preferred source.

2.1.10 Green Indicating Light

A green indicating light shall supervise/provide preferred power source switch position indication and shall have a nameplate engraved PREFERRED.

2.1.11 Red Indicating Light

A red indicating light shall supervise/provide alternate power source switch position indication and shall have a nameplate engraved ALTERNATE .

2.2 ENCLOSURE

ATS and accessories shall be installed in free-standing, floor-mounted, ventilated NEMA ICS 6, Type 1 , smooth sheet metal enclosure constructed in accordance with applicable requirements of UL 1066 and/or UL 1008. Intake vent shall be screened and filtered. Exhaust vent shall be screened. Door shall have suitable hinges, locking handle latch, and gasketed jamb. Metal gauge shall be not less than No. 14. Enclosure shall be equipped with at least two approved grounding lugs for grounding enclosure to facility ground system using No. 4 AWG copper conductors. Factory wiring within enclosure and field wiring terminating within enclosure shall comply with NFPA 70. If wiring is not color coded, wire shall be permanently tagged or marked near terminal at each end with wire number shown on approved detail drawing. Terminal block shall conform to NEMA ICS 4. Terminals shall be arranged for entrance of external conductors from top and bottom of enclosure as shown. Main switch terminals, including neutral terminal if used, shall be pressure type suitable for termination of external copper conductors shown.

2.2.1 Construction

Enclosure shall be constructed for ease of removal and replacement of ATS components and control devices from front without disconnection of external power conductors or removal or disassembly of major components.

2.2.2 Cleaning and Painting

Both the inside and outside surfaces of an enclosure, including means for fastening, shall be protected against corrosion by enameling, galvanizing, plating, powder coating, or other equivalent means. Protection is not required for metal parts that are inherently resistant to corrosion, bearings, sliding surfaces of hinges, or other parts where such protection

is impractical. Finish shall be manufacturer's standard material, process, and color and shall be free from runs, sags, peeling, or other defects. An enclosure marked Type 1, 3R, 4 or 12 shall be acceptable if there is no visible rust at the conclusion of a salt spray (fog) test using the test method in ASTM B 117, employing a 5 percent by weight, salt solution for 24 hours. Type 4X enclosures are acceptable following performance of the above test with an exposure time of 200 hours.

2.3 TESTING

2.3.1 Factory Testing

A prototype of specified ATS shall be factory tested in accordance with UL 1008. In addition, factory tests shall be performed on each ATS as follows:

- a. Insulation resistance test to ensure integrity and continuity of entire system.
- b. Main switch contact resistance test.
- c. Visual inspection to verify that each ATS is as specified.
- d. Mechanical test to verify that ATS sections are free of mechanical hindrances.
- e. Electrical tests to verify complete system electrical operation and to set up time delays and voltage sensing settings.

2.3.2 Factory Test Reports

Manufacturer shall provide three certified copies of factory test reports.

PART 3 EXECUTION

3.1 INSTALLATION

ATS shall be installed as shown and in accordance with approved manufacturer's instructions.

3.2 INSTRUCTIONS

Manufacturer's approved operating instructions shall be permanently secured to cabinet where operator can see them. One-line and elementary or schematic diagram shall be permanently secured to inside of front enclosure door.

3.3 SITE TESTING

Following completion of ATS installation and after making proper adjustments and settings, site tests shall be performed in accordance with manufacturer's written instructions to demonstrate that each ATS functions satisfactorily and as specified. Contractor shall advise Contracting Officer not less than 5 working days prior to scheduled date for site testing, and shall provide certified field test reports within 2 calendar

weeks following successful completion of site tests. Test reports shall describe adjustments and settings made and site tests performed. Minimum operational tests shall include the following:

- a. Insulation resistance shall be tested, both phase-to-phase and phase-to-ground.
- b. Power failure of normal source shall be simulated by opening upstream protective device. This test shall be performed a minimum of five times.
- c. Power failure of emergency source with normal source available shall be simulated by opening upstream protective device for emergency source. This test shall be performed a minimum of five times.
- d. Low phase-to-ground voltage shall be simulated for each phase of normal source.
- e. Operation and settings shall be verified for specified ATS features, such as override time delay, transfer time delay, return time delay, engine shutdown time delay, exerciser, auxiliary contacts, and supplemental features.
- f. Manual and automatic ATS functions shall be verified.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16415

ELECTRICAL WORK, INTERIOR

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL
 - 1.2.1 Rules
 - 1.2.2 Coordination
 - 1.2.3 Special Environments
 - 1.2.3.1 Weatherproof Locations
 - 1.2.3.2 Ducts, Plenums and Other Air-Handling Spaces
 - 1.2.4 Standard Products
 - 1.2.5 Nameplates
 - 1.2.5.1 Identification Nameplates
 - 1.2.6 As-Built Drawings
- 1.3 SUBMITTALS
- 1.4 WORKMANSHIP

PART 2 PRODUCTS

- 2.1 CABLES AND WIRES
 - 2.1.1 Equipment Manufacturer Requirements
 - 2.1.2 Aluminum Conductors
 - 2.1.3 Insulation
 - 2.1.4 Bonding Conductors
- 2.2 TRANSIENT VOLTAGE SURGE PROTECTION
- 2.3 CIRCUIT BREAKERS
 - 2.3.1 MOLDED-CASE CIRCUIT BREAKERS
 - 2.3.1.1 Construction
 - 2.3.1.2 Ratings
 - 2.3.1.3 Thermal-Magnetic Trip Elements
 - 2.3.2 Ground Fault Circuit Interrupters
- 2.4 CONDUIT AND TUBING
 - 2.4.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)
 - 2.4.2 Electrical Nonmetallic Tubing (ENT)
 - 2.4.3 Flexible Conduit, Steel and Plastic
 - 2.4.4 Intermediate Metal Conduit
 - 2.4.5 PVC Coated Rigid Steel Conduit
 - 2.4.6 Rigid Metal Conduit
 - 2.4.7 Rigid Plastic Conduit
- 2.5 CONDUIT AND DEVICE BOXES AND FITTINGS
 - 2.5.1 Boxes, Metallic Outlet
 - 2.5.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

- 2.5.3 Boxes, Switch (Enclosed), Surface-Mounted
- 2.5.4 Fittings for Conduit and Outlet Boxes
- 2.5.5 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing
- 2.6 CONDUIT COATINGS PLASTIC RESIN SYSTEM
- 2.7 CONNECTORS, WIRE PRESSURE
 - 2.7.1 For Use With Copper Conductors
 - 2.7.2 For Use With Aluminum Conductors
- 2.8 ELECTRICAL GROUNDING AND BONDING EQUIPMENT
- 2.9 ENCLOSURES
 - 2.9.1 Cabinets and Boxes
 - 2.9.2 Circuit Breaker Enclosures
- 2.10 LIGHTING FIXTURES, LAMPS, BALLASTS, EMERGENCY EQUIPMENT, CONTROLS AND ACCESSORIES
 - 2.10.1 Lamps
 - 2.10.2 Ballasts and Transformers
 - 2.10.3 Fixtures
 - 2.10.4 Lampholders, Starters, and Starter Holders
- 2.11 MOTORS, AC, FRACTIONAL AND INTEGRAL
 - 2.11.1 Rating
 - 2.11.1.1 Thermal Protection
 - 2.11.1.2 Space Heaters
 - 2.11.2 Motor Efficiencies
- 2.12 RECEPTACLES
 - 2.12.1 Heavy Duty Grade
 - 2.12.2 Standard Grade
 - 2.12.3 Ground Fault Interrupters
 - 2.12.4 NEMA Standard Receptacle Configurations
- 2.13 SPLICE, CONDUCTOR
- 2.14 TAPES
 - 2.14.1 Plastic Tape
 - 2.14.2 Rubber Tape
- 2.15 TRANSFORMERS
 - 2.15.1 Transformers, Dry-Type
 - 2.15.2 Average Sound Level
- 2.16 WIRING DEVICES
- 2.17 SAFETY SWITCHES (DISCONNECTS AND MANUAL TRANSFER SWITCHES)

PART 3 EXECUTION

- 3.1 GROUNDING
 - 3.1.1 Grounding Conductors
- 3.2 WIRING METHODS
 - 3.2.1 Conduit and Tubing Systems
 - 3.2.1.1 Pull Wires
 - 3.2.1.2 Conduit Stub-Ups
 - 3.2.1.3 Below Slab-on-Grade or in the Ground
 - 3.2.1.4 Installing in Slabs Including Slabs on Grade
 - 3.2.1.5 Changes in Direction of Runs
 - 3.2.1.6 Supports
 - 3.2.1.7 Exposed Raceways
 - 3.2.1.8 Communications Raceways
 - 3.2.2 Cables and Conductors
 - 3.2.2.1 Sizing
 - 3.2.2.2 Use of Aluminum Conductors in Lieu of Copper

- 3.2.2.3 Cable Splicing
- 3.2.2.4 Conductor Identification and Tagging
- 3.3 BOXES AND SUPPORTS
 - 3.3.1 Box Applications
 - 3.3.2 Brackets and Fasteners
 - 3.3.3 Mounting in Walls, Ceilings, or Recessed Locations
 - 3.3.4 Installation in Overhead Spaces
- 3.4 DEVICE PLATES
- 3.5 RECEPTACLES
 - 3.5.1 Single and Duplex, 20-ampere, 125 volt
 - 3.5.2 Weatherproof Applications
 - 3.5.2.1 Damp Locations
 - 3.5.2.2 Wet and Corrosive Locations
 - 3.5.3 Special-Purpose or Heavy-Duty Receptacles
- 3.6 WALL SWITCHES
- 3.7 PANELBOARDS AND LOADCENTERS
 - 3.7.1 Loadcenters
 - 3.7.2 Panelboards
- 3.8 FUSES
 - 3.8.1 Cartridge Fuses; Noncurrent-Limiting Type
- 3.9 MOTORS
- 3.10 TRANSFORMER INSTALLATION
- 3.11 LIGHTING FIXTURES, LAMPS AND BALLASTS
 - 3.11.1 Lamps
 - 3.11.2 Lighting Fixtures
 - 3.11.2.1 Accessories
 - 3.11.2.2 Ceiling Fixtures
 - 3.11.2.3 Fixtures for Installation in Grid Type Ceilings
 - 3.11.2.4 Suspended Fixtures
 - 3.11.3 Ballasts
 - 3.11.4 Emergency Light Sets
- 3.12 BATTERY CHARGERS
- 3.13 EQUIPMENT CONNECTIONS
 - 3.13.1 Motors and Motor Control
 - 3.13.2 Installation of Government-Furnished Equipment
- 3.14 CIRCUIT PROTECTIVE DEVICES
- 3.15 PAINTING AND FINISHING
- 3.16 REPAIR OF EXISTING WORK
- 3.17 FIELD TESTING
 - 3.17.1 Safety
 - 3.17.2 Cable Tests
 - 3.17.2.1 Low Voltage Cable Tests
 - 3.17.3 Motor Tests
 - 3.17.4 Dry-Type Transformer Tests
 - 3.17.5 Circuit Breaker Tests
 - 3.17.5.1 Circuit Breakers, Molded Case
- 3.18 OPERATING TESTS
- 3.19 FIELD SERVICE
 - 3.19.1 Onsite Training
 - 3.19.2 Installation Engineer
- 3.20 ACCEPTANCE

-- End of Section Table of Contents --

SECTION 16415

ELECTRICAL WORK, INTERIOR
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(1995) Code for Electricity Metering
ANSI C12.4	(1984; R 1996) Mechanical Demand Registers
ANSI C12.10	(1997) Electromechanical Watthour Meters
ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL Through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C37.16	(1997) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
ANSI C39.1	(1981; R 1992) Requirements for Electrical Analog Indicating Instruments
ANSI C57.12.10	(1988) Safety Requirements for Transformers 230 kV and Below 833/958 Through 8333/10417 kVA, Single-Phase, and 750/862 Through 60 000/80 000/100 000 kVA, Three-Phase Without Load Tap Charging; and 3750/4687 Through 60 000/80 000/100 000 kVA With Load Tap Charging
ANSI C57.12.13	(1982) Conformance Requirements for Liquid-Filled Transformers Used in Unit Installations, Including Unit Substations
ANSI C57.12.27	(1982) Conformance Requirements for Liquid-Filled Distribution Transformers Used in Pad-Mounted Installations, Including Unit Substations

ANSI C57.12.50	(1981; R 1989) Ventilated Dry-type Distribution Transformers 1 to 500 kVA, Single-Phase; and 15 to 500 kVA, Three-Phase with High-Voltage 601 to 34 500 Volts, Low-Voltage 120 to 600 Volts
ANSI C57.12.51	(1981; R 1989) Ventilated Dry-Type Power Transformers, 501 kVA and Larger, Three-Phase, with High-Voltage 601 to 34 500 Volts, Low-Voltage 208Y/120 to 4160 Volts
ANSI C57.12.52	(1981; R 1989) Sealed Dry-Type Power Transformers, 501 kVA and Larger, Three-Phase with High-Voltage 601 to 34 500 Volts, Low-Voltage 208Y/120 to 4160 Volts
ANSI C57.12.70	(1978; R 1993) Terminal Markings and Connections for Distribution and Power Transformers
ANSI C78.1	(1991; C78.1a; R 1996) Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics
ANSI C78.20	(1995) Electric Lamps - Characteristics of Incandescent Lamps A, G, PS, and Similar Shapes with E26 Medium Screw Bases
ANSI C78.21	(1995) Physical and Electrical Characteristics - Incandescent Lamps - PAR and R Shapes
ANSI C78.1350	(1990) 400-Watt, 100-Volt, S51 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1351	(1989) 250-Watt, 100-Volt S50 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1352	(1990) 1000-Watt, 250-Volt, S52 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1355	(1989) 150-Watt, 55-Volt S55 High-Pressure Sodium Lamps
ANSI C78.1375	(1996) 400-Watt, M59 Single-Ended Metal-Halide lamps
ANSI C78.1376	(1996) 1000-Watt, M47 Single-Ended Metal-Halide Lamps
ANSI C78.2A	(1991) 18 & 26- Watt, Compact Fluorescent Quad Tube Lamps

ANSI C78.2B	(1992) 9 & 13-Watt, Compact Fluorescent Quad Tube Lamps
ANSI C80.5	(1995) Rigid Aluminum Conduit
ANSI C82.1	(1997) Specifications for Fluorescent Lamp Ballasts
ANSI C82.4	(1992) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 1	(1995) Hard-Drawn Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 709	(1992; R 1997) Laminated Thermosetting Materials
ASTM D 4059	(1996) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography

CODE OF FEDERAL REGULATIONS (CFR)

47 CFR 18	Industrial, Scientific, and Medical Equipment
-----------	---

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE C37.13	(1990; R 1995) Low-Voltage AC Power Circuit Breakers Used in Enclosures
IEEE C37.20.1	(1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
IEEE C57.12.00	(1993) IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.12.80	(1996) Terminology for Power and Distribution Transformers
IEEE C57.12.90	(1993) Test Code for Liquid-Immersed Distribution, Power, and Regulating

Transformers and Guide for Short-Circuit
Testing of Distribution and Power
Transformers

IEEE C57.13	(1993) Instrument Transformers
IEEE C57.98	(1993) Guide for Transformer Impulse Tests
IEEE C57.100	(1986; R 1992) Test Procedure for Thermal Evaluation of Oil-Immersed Distribution Transformers
IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 242	(1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE Std 399	(1997) Recommended Practice for Industrial and Commercial Power Systems Analysis

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA BU 1	(1994) Busways
NEMA FU 1	(1986) Low Voltage Cartridge Fuses
NEMA ICS 1	(1993) Industrial Control and Systems
NEMA ICS 2	(1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC
NEMA ICS 3	(1993) Industrial Control and Systems Factory Built Assemblies
NEMA ICS 6	(1993) Industrial Control and Systems Enclosures
NEMA LE 4	(1987) Recessed Luminaires, Ceiling Compatibility

NEMA MG 1	(1993; Rev 1; Rev 2; Rev 3; Rev 4) Motors and Generators
NEMA MG 10	(1994) Energy Management Guide for Selection and Use of Polyphase Motors
NEMA OS 1	(1996) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA OS 2	(1986; Errata Aug 1986; R 1991) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA PB 1	(1995) Panelboards
NEMA PB 2	(1995) Deadfront Distribution Switchboards
NEMA PE 5	(1996) Utility Type Battery Chargers
NEMA RN 1	(1989) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA SG 3	(1995) Power Switching Equipment
NEMA ST 20	(1992) Dry-Type Transformers for General Applications
NEMA TC 2	(1990) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA TC 13	(1993) Electrical Nonmetallic Tubing (ENT)
NEMA VE 1	(1996) Metal Cable Tray Systems
NEMA WD 1	(1983; R 1989) General Requirements for Wiring Devices
NEMA WD 6	(1988) Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
NFPA 101	(1997; Errata 97-1; TIA 97-1) Life Safety Code

UNDERWRITERS LABORATORIES (UL)

UL 1	(1993; Rev thru Jan 1995) Flexible Metal Conduit
------	--

UL 4	(1996) Armored Cable
UL 5	(1996) Surface Metal Raceways and Fittings
UL 6	(1997) Rigid Metal Conduit
UL 20	(1995; Rev thru Oct 1998) General-Use Snap Switches
UL 44	(1997; Rev Mar 1999) Thermoset-Insulated Wires and Cables
UL 50	(1995; Rev thru Oct 1997) Enclosures for Electrical Equipment
UL 67	(1993; Rev thru Nov 1995) Panelboards
UL 83	(1998) Thermoplastic-Insulated Wires and Cables
UL 98	(1994; R thru Jun 1998) Enclosed and Dead-Front Switches
UL 198B	(1995) Class H Fuses
UL 198C	(1986; Rev thru Feb 1998) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198D	(1995) Class K Fuses
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198G	(1988; Rev May 1988) Fuses for Supplementary Overcurrent Protection
UL 198H	(1988; Rev thru Nov 1993) Class T Fuses
UL 198L	(1995; Rev May 1995) D-C Fuses for Industrial Use
UL 360	(1996; Rev thru Oct 1997) Liquid-Tight Flexible Steel Conduit
UL 467	(1993; Rev thru Aug 1996) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru Dec 1998) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors

UL 486C	(1997; Rev thru Aug 1998) Splicing Wire Connectors
UL 486E	(1994; Rev thru Feb 1997) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
UL 489	(1996; Rev thru Dec 1998) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(1996; Rev thru Sep 1998) Attachment Plugs and Receptacles
UL 506	(1994; Rev Oct 1997) Specialty Transformers
UL 508	(1999) Industrial Control Equipment
UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 512	(1993; R Dec 1995) Fuseholders
UL 514A	(1996; Rev Jul 1998) Metallic Outlet Boxes
UL 514B	(1997; Rev Oct 1998) Fittings for Cable and Conduit
UL 514C	(1996; R Sep 1998) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 542	(1994; Rev thru Jul 1998) Lampholders, Starters, and Starter Holders for Fluorescent Lamps
UL 651	(1995; Rev thru Oct 1998) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(1995; Rev thru Apr 1998) Type EB and A Rigid PVC Conduit and HDPE Conduit
UL 674	(1994; Rev thru Oct 1998) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
UL 698	(1999)) Industrial Control Equipment for Use in Hazardous (Classified) Locations
UL 719	(1999) Nonmetallic-Sheathed Cables
UL 797	(1993; Rev thru Mar 1997) Electrical Metallic Tubing

UL 817	(1994; Rev thru Jul 1998) Cord Sets and Power-Supply Cords
UL 844	(1995; Rev thru Aug 1997) Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
UL 845	(1995; Rev Feb 1996) Motor Control Centers
UL 854	(1996; Rev Apr 1998) Service-Entrance Cables
UL 857	(1994; Rev thru May 1999) Busways and Associated Fittings
UL 869A	(1998) Reference Standard for Service Equipment
UL 877	(1993; Rev thru May 1997) Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous (Classified) Locations
UL 886	(1994; Rev thru Apr 1999) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
UL 891	(1994; Rev thru Jan 1995) Dead-Front Switchboards
UL 916	(1998) Energy Management Equipment
UL 924	(1995; Rev thru Oct 97) Emergency Lighting and Power Equipment
UL 935	(1995; Rev thru Oct 1998) Fluorescent-Lamp Ballasts
UL 943	(1993; Rev thru May 1998) Ground-Fault Circuit-Interrupters
UL 1004	(1994; Rev thru Dec 1997) Electric Motors
UL 1010	(1995; Rev thru Dec 1996) Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations
UL 1022	(1998) Line Isolation Monitors
UL 1029	(1994; Rev thru Dec 1997) High-Intensity-Discharge Lamp Ballasts
UL 1047	(1995; Rev Jul 1998) Isolated Power Systems Equipment

UL 1236	(1994; Rev thru Dec 1997) Battery Chargers for Charging Engine-Starter Batteries
UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit
UL 1449	(1996; Rev thru Oct 1998) Transient Voltage Surge Suppressors
UL 1564	(1993; Rev Sep 1998) Industrial Battery Chargers
UL 1569	(1995; Rev thru Sep 1998) Metal-Clad Cables
UL 1570	(1995; Rev thru Jun 1997) Fluorescent Lighting Fixtures
UL 1571	(1995; Rev thru Jun 1997) Incandescent Lighting Fixtures
UL 1572	(1995; Rev thru Jun 1997) High Intensity Discharge Lighting Fixtures
UL 1660	(1994; Rev Apr 1998) Liquid-Tight Flexible Nonmetallic Conduit
UL Elec Const Dir	(1998) Electrical Construction Equipment Directory

1.2 GENERAL

1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated or shown.

1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible.

Lighting fixtures, outlets, and other equipment and materials shall be carefully coordinated with mechanical or structural features prior to installation and positioned according to architectural reflected ceiling plans; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. The Contractor shall coordinate the electrical requirements of the

mechanical work and provide all power related circuits, wiring, hardware and structural support, even if not shown on the drawings.

1.2.3 Special Environments

1.2.3.1 Weatherproof Locations

Wiring, Fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

1.2.3.2 Ducts, Plenums and Other Air-Handling Spaces

Wiring and equipment in ducts, plenums and other air-handling spaces shall be installed using materials and methods in conformance with NFPA 70 unless more stringent requirements are indicated in this specification or on the contract drawings.

1.2.4 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.5 Nameplates

1.2.5.1 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The front of each panelboard, motor control center, switchgear, and switchboard shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 1/4 inch
High Letters

Panelboards
Starters
Safety Switches

Minimum 1/8 inch
High Letters

Control Power Transformers
Control Devices
Instrument Transformers

Minimum 1/4 inch
High Letters
Motor Control Centers
Transformers
Equipment Enclosures
Switchgear
Switchboards
Motors

Minimum 1/8 inch
High Letters

Each panel, section, or unit in motor control centers, switchgear or similar assemblies shall be provided with a nameplate in addition to nameplates listed above, which shall be provided for individual compartments in the respective assembly, including nameplates which identify "future," "spare," and "dedicated" or "equipped spaces."

1.2.6 As-Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish 2 sets of as-built drawings to the Contracting Officer.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Catalog; FIO.

Data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; FIO.

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each item.

Installation Procedures; FIO.

Installation procedures for rotating equipment, transformers, switchgear, battery systems, voltage regulators, and grounding resistors. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test devices and equipment.

SD-04 Drawings

As-Built Drawings; FIO.

The as-built drawings shall be a record of the construction as installed.

The drawings shall include all the information shown on the contract drawings, deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full-sized set of prints marked to reflect all deviations, changes, and modifications. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

SD-08 Statements

Onsite Test; FIO.

A detailed description of the Contractor's proposed procedures for on-site tests.

SD-09 Reports

Materials and Equipment; FIO.

The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Items which are required to be listed and labeled in accordance with Underwriters Laboratories must be affixed with a UL label that states that it is UL listed. No exceptions or waivers will be granted to this requirement. Materials and equipment will be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with NFPA 70, recommendations of the manufacturer, and as shown.

PART 2 PRODUCTS

Products shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.1 CABLES AND WIRES

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to meet manufacturer's requirements.

2.1.2 Aluminum Conductors

Aluminum conductors shall not be used.

2.1.3 Insulation

Unless indicated otherwise, or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN, THHN, or THW conforming to UL 83, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW, THW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.1.4 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.2 TRANSIENT VOLTAGE SURGE PROTECTION

Transient voltage surge suppressors shall be provided as indicated. Surge suppressors shall meet the requirements of IEEE C62.41 and be UL listed and labeled as having been tested in accordance with UL 1449. Surge suppressor ratings shall be 480 volts rms, operating voltage; 60 Hz; 3-phase; 4 wire with ground; transient suppression voltage (peak let-through voltage) of 1500 volts. Each phase shall have 80 kA surge current protection. Surge protection shall be provided L-G, L-N and N-G. Fuses shall not be used as surge suppression.

2.3 CIRCUIT BREAKERS

2.3.1 MOLDED-CASE CIRCUIT BREAKERS

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489 and UL 877 for circuit breakers. Circuit breakers may be installed in panelboards, switchboards, enclosures, motor control centers, or combination motor controllers.

2.3.1.1 Construction

Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper and aluminum conductors in accordance with UL 486E. Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible.

2.3.1.2 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards and switchboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1.

2.3.1.3 Thermal-Magnetic Trip Elements

Thermal magnetic circuit breakers shall be provided as shown. Automatic operation shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers on frame sizes above 150 amperes.

2.3.2 Ground Fault Circuit Interrupters

UL 943. Breakers equipped with ground fault circuit interrupters shall have ground fault class, interrupting capacity, and voltage and current ratings as indicated.

2.4 CONDUIT AND TUBING

2.4.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797

2.4.2 Electrical Nonmetallic Tubing (ENT)

NEMA TC 13.

2.4.3 Flexible Conduit, Steel and Plastic

General-purpose type, UL 1; liquid tight, UL 360, and UL 1660.

2.4.4 Intermediate Metal Conduit

UL 1242.

2.4.5 PVC Coated Rigid Steel Conduit

NEMA RN 1.

2.4.6 Rigid Metal Conduit

UL 6.

2.4.7 Rigid Plastic Conduit

NEMA TC 2, UL 651 and UL 651A.

2.5 CONDUIT AND DEVICE BOXES AND FITTINGS

2.5.1 Boxes, Metallic Outlet

NEMA OS 1 and UL 514A.

2.5.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

NEMA OS 2 and UL 514C.

2.5.3 Boxes, Switch (Enclosed), Surface-Mounted

UL 98.

2.5.4 Fittings for Conduit and Outlet Boxes

UL 514B.

2.5.5 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

2.6 CONDUIT COATINGS PLASTIC RESIN SYSTEM

NEMA RN 1, Type A-40.

2.7 CONNECTORS, WIRE PRESSURE

2.7.1 For Use With Copper Conductors

UL 486A.

2.7.2 For Use With Aluminum Conductors

UL 486B.

2.8 ELECTRICAL GROUNDING AND BONDING EQUIPMENT

UL 467.

2.9 ENCLOSURES

2.9.1 Cabinets and Boxes

Cabinets and boxes with volume greater than 100 cubic inches shall be in accordance with UL 50, hot-dip, zinc-coated, if sheet steel.

2.9.2 Circuit Breaker Enclosures

UL 489.

2.10 LIGHTING FIXTURES, LAMPS, BALLASTS, EMERGENCY EQUIPMENT, CONTROLS AND ACCESSORIES

The following specifications are supported and supplemented by information and details on the drawings. Additional fixtures, if shown, shall conform to this specification. Lighting equipment installed in classified hazardous locations shall conform to UL 844. Lamps, lampholders, ballasts, transformers, electronic circuitry and other lighting system components shall be constructed according to industry standards. Equipment shall be tested and listed by a recognized independent testing laboratory for the expected installation conditions. Equipment shall conform to the standards listed below.

2.10.1 Lamps

Lamps shall be constructed to operate in the specified fixture, and shall function without derating life or output as listed in published data. Lamps shall meet the requirements of the Energy Policy Act of 1992.

- a. Fluorescent lamps shall have color temperature 3,000 degrees Kelvin. They shall be designed to operate with the ballasts and circuitry of the fixtures in which they will be used. Fluorescent lamps, including spares, shall be manufactured by one manufacturer to provide for color and performance consistency. Fluorescent lamps shall comply with ANSI C78.1. Fluorescent tube lamp efficiencies shall meet or exceed the following requirements.

T8, 32 watts	(4' lamp)	2800 lumens
T12, 34 watts	(4' lamp)	2800 lumens
T8, 59 watts	(8' lamp)	5700 lumens
T12, 60 watts	(8' lamp)	5600 lumens
T8/U, 31-32 watts	(U-tube)	2600 lumens
T12/U, 34 watts	(U-tube)	2700 lumens

(1) Linear fluorescent lamps, unless otherwise indicated, shall be 4 feet long 32 watt T8, 265 mA, with minimum CRI of 75. Lamps of other lengths or types shall be used only where specified or shown. Lamps shall deliver rated life when operated on rapid start ballasts.

(2) Small compact fluorescent lamps shall be twin, double, or triple tube configuration as shown with bi-pin or four-pin snap-in base and shall have minimum CRI of 85. They shall deliver rated life when operated on ballasts as shown. 9 and 13 watt double tube lamps shall comply with ANSI C78.2B. 18 and 26 watt double tube lamps shall comply with ANSI C78.2A. Minimum starting temperature shall be 32 degrees F for twin tube lamps and for double and triple twin tube lamps without internal starter; and 15 degrees F for double and triple twin tube lamps with internal starter.

(3) Long compact fluorescent lamps shall be 18, 27, 39, 40, 50, or 55 watt bi-axial type as shown with four-pin snap-in base; shall have minimum CRI of 85; and shall have a minimum starting temperature of 50 degrees F. They shall deliver rated life when operated on rapid start ballasts.

- b. High intensity discharge lamps, including spares, shall be manufactured by one manufacturer in order to provide color and performance consistency. High intensity discharge lamps shall be designed to operate with the ballasts and circuitry of the fixtures in which they will be used and shall have wattage, shape and base as shown. High intensity discharge lamps, unless otherwise shown, shall have medium or mogul screw base and minimum starting temperature of -20 degrees F. Metal halide lamps, unless otherwise shown, shall have minimum CRI of 65; color temperature of 4,300 degrees Kelvin; shall be -BU configuration if used in base-up position; and shall be -H or high output configuration if used in horizontal position. Lamps shall comply with all applicable ANSI C78.1350, ANSI C78.1351, ANSI C78.1352, ANSI C78.1355, ANSI C78.1375, and ANSI C78.1376.

2.10.2 Ballasts and Transformers

Ballasts or transformers shall be designed to operate the designated lamps within their optimum specifications, without derating the lamps. Lamp and ballast combinations shall be certified as acceptable by the lamp manufacturer.

- a. Low voltage incandescent transformers shall be Class II UL listed 120/12 volt or 120/24 volt step-down transformers as required for the lamps shown. Transformers shall be high power factor type and shall be rated for continuous operation under the specified load. Transformers shall be encased or encased and potted, and mounted integrally within the lighting fixture unless otherwise shown.
- b. Fluorescent ballasts shall comply with ANSI C82.1 and shall be mounted integrally within fluorescent fixture housing unless otherwise shown. Ballasts shall have maximum current crest factor of 1.7; high power factor; Class A sound rating; maximum operating case temperature of 77 degrees F above ambient; and shall be rated Class P. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture. A single ballast may be used to serve multiple fixtures if they are continuously mounted, identically controlled and factory manufactured for that installation with an integral wireway.

(1) Compact fluorescent ballasts shall comply with IEEE C62.41 Category A transient voltage variation requirements and shall be mounted integrally within compact fluorescent fixture housing unless otherwise shown. Ballasts shall have minimum ballast factor of 0.95; maximum current crest factor of 1.6; high power factor; maximum operating case temperature of 77 degrees F above ambient; shall be rated Class P; and shall have a sound rating of Class A. Ballasts shall meet FCC Class A specifications for EMI/RFI emissions. Ballasts shall operate from nominal line voltage of 120 volts at 60 Hz and maintain constant light output over a line voltage variation of $\pm 10\%$. Ballasts shall have an end-of-lamp-life detection and shut-down circuit. Ballasts shall be UL listed and shall contain no PCBs. Ballasts shall contain potting to secure PC board, provide lead strain relief, and provide a moisture barrier.

(2) Electronic fluorescent ballasts shall comply with 47 CFR 18 for electromagnetic interference. Ballasts shall withstand line transients per IEEE C62.41, Category A. Ballasts shall have total harmonic distortion between 10 and 20%; minimum frequency of 20,000Hz; filament voltage between 2.5 and 4.5 volts; maximum starting inrush current of 20 amperes; and shall comply with the minimum Ballast Efficacy Factors shown in the table below. Minimum starting temperature shall be 30 degrees F. Ballasts shall carry a manufacturer's full warranty of three years, including a minimum \$10 labor allowance per ballast.

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS

LAMP TYPE	TYPE OF STARTER & LAMP	NOMINAL OPERATIONAL VOLTAGE	NUMBER OF LAMPS	MINIMUM BALLAST EFFICACY FACTOR
--------------	------------------------------	-----------------------------------	-----------------------	--

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS					
32W T8	rapid	120 or 277 V	1	2.54	
	start		2	1.44	
	linear &		3	0.93	
	U-tubes		4	0.73	
<hr/>					
34W T12	rapid	120 or 277 V	1	2.64	
	start		2	1.41	
	linear &		3	0.93	
	U-tubes				
<hr/>					
59W T8	rapid	120 or 277 V	2	0.80	
	start				
	linear				
<hr/>					
60W T12	rapid	120 or 277 V	2	0.80	
	start				
	linear				

2.10.3 Fixtures

Fixtures shall be in accordance with the size, shape, appearance, finish, and performance shown. Unless otherwise indicated, lighting fixtures shall be provided with housings, junction boxes, wiring, lampholders, mounting supports, trim, hardware and accessories for a complete and operable installation. Recessed housings shall be minimum 20 gauge cold rolled or galvanized steel as shown. Extruded aluminum fixtures shall have minimum wall thickness of 0.125 inches. Plastic lenses shall be 100% virgin acrylic or as shown. Glass lenses shall be tempered. Heat resistant glass shall be borosilicate type. Conoid recessed reflector cones shall be Alzak with clear specular low iridescent finish.

- a. Incandescent fixtures shall comply with UL 1571. Incandescent fixture specular reflector cone trims shall be integral to the cone and shall be finished to match. Painted trim finishes shall be white with minimum reflectance of 88%. Low voltage incandescent fixtures shall have integral step-down transformers.
- b. Fluorescent fixtures shall comply with UL 1570. Recessed ceiling fixtures shall comply with NEMA LE 4. Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Marking shall be readily visible to service personnel, but not visible from normal viewing angles. Fluorescent fixture lens frames on recessed and surface mounted troffers shall be one assembly with mitered corners. Parabolic louvers shall have a low iridescent finish and 45 degree cut-off. Louver intersection joints shall be hairline type and shall conceal mounting tabs or other assembly methods. Louvers shall be free from blemishes, lines or defects which distort the visual surface. Integral ballast and wireway compartments shall be easily accessible without the use of special tools. Housings

shall be constructed to include grounding necessary to start the lamps. Open fixtures shall be equipped with a sleeve, wire guard, or other positive means to prevent lamps from falling. Medium bi-pin lampholders shall be twist-in type with positive locking position. Long compact fluorescent fixtures and fixtures utilizing U-bend lamps shall have clamps or secondary lampholders to support the free ends of the lamps.

- c. High intensity discharge fixture shall comply with UL 1572. Recessed ceiling fixtures shall comply with NEMA LE 4. Reflectors shall be anodized aluminum. Fixtures for horizontal lamps shall have position oriented lampholders. Lampholders shall be pulse-rated to 5,000 volts. Fixtures indicated as classified or rated for hazardous locations or special service shall be designed and independently tested for the environment in which they are installed. Recessed lens fixtures shall have extruded aluminum lens frames. Ballasts shall be integral to fixtures and shall be accessible without the use of special tools. Remote ballasts shall be encased and potted. Lamps shall be shielded from direct view with a UV absorbing material such as tempered glass, and shall be circuited through a cut-off switch which will shut off the lamp circuit if the lens is not in place.
- d. Emergency lighting fixtures and accessories shall be constructed and independently tested to meet the requirements of applicable codes. Batteries shall be Nicad or equal with no required maintenance, and shall have a minimum life expectancy of five years and warranty period of three years.

2.10.4 Lampholders, Starters, and Starter Holders

UL 542

2.11 MOTORS, AC, FRACTIONAL AND INTEGRAL

Motors, ac, fractional and integral horsepower, 500 hp and smaller shall conform to NEMA MG 1 and UL 1004 for motors; NEMA MG 10 for energy management selection of polyphase motors. In addition to the standards listed above, motors shall be provided with efficiencies as specified in the table "MINIMUM NOMINAL EFFICIENCIES" below.

2.11.1 Rating

The horsepower rating of motors should be limited to no more than 125 percent of the maximum load being served unless a NEMA standard size does not fall within this range. In this case, the next larger NEMA standard motor size should be used.

2.11.1.1 Thermal Protection

In each motor to be used with adjustable speed drives, in all motors 60 horsepower and larger, or where called for in the Specifications for the driven equipment, provide integral thermostats or other approved devices to protect the motor from overheating. Thermostats or other devices shall be

normally closed and rated 125 Vac, 1 amp.

2.11.1.2 Space Heaters

Where called for in the Specifications for the driven equipment, provide space heaters or solid state motor winding heating systems for motors. Heaters shall be 120 or 240 volts, single phase, as required by the control circuit voltage. Heater wattage and voltage ratings shall be indicated on motor nameplate.

2.11.2 Motor Efficiencies

All permanently wired polyphase motors of 1 hp or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 1 hp or more with open, drip proof or totally enclosed fan cooled enclosures shall be high efficiency type, unless otherwise indicated. Motor efficiencies indicated in the tables apply to general-purpose, single-speed, polyphase induction motors. Applications which require definite purpose, special purpose, special frame, or special mounted polyphase induction motors are excluded from these efficiency requirements. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

MINIMUM NOMINAL MOTOR EFFICIENCIES
OPEN DRIP PROOF MOTORS

<u>kW</u>	<u>1200 RPM</u>	<u>1800 RPM</u>	<u>3600 RPM</u>
0.746	82.5	85.5	80.0
1.12	86.5	86.5	85.5
1.49	87.5	86.5	86.5
2.24	89.5	89.5	86.5
3.73	89.5	89.5	89.5
5.60	91.7	91.0	89.5
7.46	91.7	91.7	90.2
11.2	92.4	93.0	91.0
14.9	92.4	93.0	92.4
18.7	93.0	93.6	93.0
22.4	93.6	93.6	93.0
29.8	94.1	94.1	93.6
37.3	94.1	94.5	93.6
44.8	95.0	95.0	94.1
56.9	95.0	95.0	94.5
74.6	95.0	95.4	94.5
93.3	95.4	95.4	95.0
112.0	95.8	95.8	95.4
149.0	95.4	95.8	95.4
187.0	95.4	96.2	95.8
224.0	95.4	95.0	95.4
261.0	94.5	95.4	95.0
298.0	94.1	95.8	95.0
336.0	94.5	95.4	95.4
373.0	94.5	94.5	94.5

MINIMUM NOMINAL MOTOR EFFICIENCIES

TOTALLY ENCLOSED FAN-COOLED MOTORS

<u>kW</u>	<u>1200 RPM</u>	<u>1800 RPM</u>	<u>3600 RPM</u>
0.746	82.5	85.5	78.5
1.12	87.5	86.5	85.5
1.49	88.5	86.5	86.5
2.24	89.5	89.5	88.5
3.73	89.5	89.5	89.5
5.60	91.7	91.7	91.0
7.46	91.7	91.7	91.7
11.2	92.4	92.4	91.7
14.9	92.4	93.0	92.4
18.7	93.0	93.6	93.0
22.4	93.6	93.6	93.0
29.8	94.1	94.1	93.6
37.3	94.1	94.5	94.1
44.8	94.5	95.0	94.1
56.9	95.0	95.4	94.5
74.6	95.4	95.4	95.0
93.3	95.4	95.4	95.4
112.0	95.8	95.8	95.4
149.0	95.8	96.2	95.8
187.0	95.6	96.2	95.9
224.0	95.4	96.1	95.8
261.0	94.5	96.2	94.8
298.0	94.5	95.8	94.5
336.0	94.5	94.5	94.5
373.0	94.5	94.5	94.5

MINIMUM NOMINAL MOTOR EFFICIENCIES
OPEN DRIP PROOF MOTORS

<u>HP</u>	<u>1200 RPM</u>	<u>1800 RPM</u>	<u>3600 RPM</u>
1	82.5	85.5	80.0
1.5	86.5	86.5	85.5
2	87.5	86.5	86.5
3	89.5	89.5	86.5
5	89.5	89.5	89.5
7.5	91.7	91.0	89.5
10	91.7	91.7	90.2
15	92.4	93.0	91.0
20	92.4	93.0	92.4
25	93.0	93.6	93.0
30	93.6	93.6	93.0
40	94.1	94.1	93.6
50	94.1	94.5	93.6
60	95.0	95.0	94.1
75	95.0	95.0	94.5
100	95.0	95.4	94.5
125	95.4	95.4	95.0
150	95.8	95.8	95.4

TOTALLY ENCLOSED FAN-COOLED MOTORS			
200	95.4	95.8	95.4
250	95.4	96.2	95.8
300	95.4	95.0	95.4
350	94.5	95.4	95.0
400	94.1	95.8	95.0
450	94.5	95.4	95.4
500	94.5	94.5	94.5

TOTALLY ENCLOSED FAN-COOLED MOTORS			
HP	1200 RPM	1800 RPM	3600 RPM
1	82.5	85.5	78.5
1.5	87.5	86.5	85.5
2	88.5	86.5	86.5
3	89.5	89.5	88.5
5	89.5	89.5	89.5
7.5	91.7	91.7	91.0
10	91.7	91.7	91.7
15	92.4	92.4	91.7
20	92.4	93.0	92.4
25	93.0	93.6	93.0
30	93.6	93.6	93.0
40	94.1	94.1	93.6
50	94.1	94.5	94.1
60	94.5	95.0	94.1
75	95.0	95.4	94.5
100	95.4	95.4	95.0
125	95.4	95.4	95.4
150	95.8	95.8	95.4
200	95.8	96.2	95.8
250	95.6	96.2	95.9
300	95.4	96.1	95.8
350	94.5	96.2	94.8
400	94.5	95.8	94.5
450	94.5	94.5	94.5
500	94.5	94.5	94.5

2.12 RECEPTACLES

2.12.1 Heavy Duty Grade

NEMA WD 1. Devices shall conform to all requirements for heavy duty receptacles.

2.12.2 Standard Grade

UL 498.

2.12.3 Ground Fault Interrupters

UL 943, Class A or B.

2.12.4 NEMA Standard Receptacle Configurations

NEMA WD 6.

a. Single and Duplex, 15-Ampere and 20-Ampere, 125 Volt

15-ampere, non-locking: NEMA type 5-15R, locking: NEMA type L5-15R,
20-ampere, non-locking: NEMA type 5-20R, locking: NEMA type L5-20R.

b. 15-Ampere, 250 Volt

Two-pole, 3-wire grounding, non-locking: NEMA type 6-15R, locking: NEMA type L6-15R. Three-pole, 4-wire grounding, non-locking: NEMA type 15-15R, locking: NEMA type L15-15R.

c. 20-Ampere, 250 Volt

Two-pole, 3-wire grounding, non-locking: NEMA type 6-20R, locking: NEMA type L6-20R. Three-pole, 4-wire grounding, non-locking: NEMA type 15-20R, locking: NEMA type L15-20R.

d. 30-Ampere, 125/250 Volt

Three-pole, 3-wire, non-locking: NEMA type 10-30R, locking: NEMA type L10-30R. Three-pole, 4-wire grounding, non-locking: NEMA type 14-30R, locking: NEMA type L14-30R.

e. 30-Ampere, 250 Volt

Two-pole, 3-wire grounding, non-locking: NEMA type 6-30R, locking: NEMA type L6-30R. Three-pole, 4-wire grounding, non-locking: NEMA type 15-30R, locking: NEMA type L15-30R.

f. 50-Ampere, 125/250 Volt

Three-pole, 3-wire: NEMA type 10-50R. Three-pole, 4-wire grounding: NEMA type 14-50R.

g. 50-Ampere, 250 Volt

Two-pole, 3-wire grounding: NEMA type 6-50R. Three-pole, 4-wire grounding: NEMA type 15-50R.

2.13 SPLICE, CONDUCTOR

UL 486C.

2.14 TAPES

2.14.1 Plastic Tape

UL 510.

2.14.2 Rubber Tape

UL 510.

2.15 TRANSFORMERS

Single- and three-phase transformers shall have two windings per phase. Full-capacity standard NEMA taps shall be provided in the primary windings of transformers unless otherwise indicated. Three-phase transformers shall be configured with delta-wye windings, except as indicated. "T" connections may be used for transformers rated 15 kVA or below.

2.15.1 Transformers, Dry-Type

Transformers shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation system for transformers rated 10 kVA and less, with temperature rise not exceeding 115 degrees C under full-rated load in maximum ambient temperature of 40 degrees C. Transformer of 115 degrees C temperature rise shall be capable of carrying continuously 115 percent of nameplate kVA without exceeding insulation rating.

a. 600 Volt or Less Primary:

NEMA ST 20, UL 506, general purpose, dry-type, self-cooled, ventilated sealed. Transformers shall be provided in NEMA 1 enclosure. Transformers shall be quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

2.15.2 Average Sound Level

The average sound level in decibels (dB) of transformers shall not exceed the following dB level at 12 inches for the applicable kVA rating range listed unless otherwise indicated:

kVA Range	dB Sound Level
1-50	50
51-150	55
151-300	58
301-500	60
501-700	62
701-1000	64

2.16 WIRING DEVICES

NEMA WD 1 for wiring devices, and NEMA WD 6 for dimensional requirements of wiring devices.

2.17 SAFETY SWITCHES (DISCONNECTS AND MANUAL TRANSFER SWITCHES)

Safety switches shall be heavy duty type with configuration, number of poles, and fusing as shown on the Drawings.

PART 3 EXECUTION

3.1 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following specifications.

3.1.1 Grounding Conductors

A green equipment grounding conductor, sized in accordance with NFPA 70 shall be provided, regardless of the type of conduit. Equipment grounding bars shall be provided in all panelboards. The equipment grounding conductor shall be carried back to the service entrance grounding connection or separately derived grounding connection. All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70. When switches, or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor junction with a short jumper.

3.2 WIRING METHODS

Wiring shall conform to NFPA 70, the contract drawings, and the following specifications. Unless otherwise indicated, wiring shall consist of insulated conductors installed in conduit. Wire fill in conduits shall be based on NFPA 70 for the type of conduit and wire insulations specified.

3.2.1 Conduit and Tubing Systems

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be 1/2 inch. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. Nonmetallic conduit and tubing may be used in damp, wet or corrosive locations when permitted by NFPA 70 and the conduit or tubing system is provided with appropriate boxes, covers, clamps, screws or other appropriate type of fittings. Electrical metallic tubing (EMT) may be installed only within buildings. EMT may be installed in concrete and grout in dry locations. EMT installed in concrete or grout shall be provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Penetrations of above grade floor slabs, time-rated partitions and fire walls shall be firestopped in accordance with Section 07840 FIRESTOPPING. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70. Raceways shall not be installed under the firepits of boilers and furnaces and shall be kept 6 inches away from parallel runs of flues, steam pipes and

hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding.

3.2.1.1 Pull Wires

A pull wire shall be inserted in each empty raceway in which wiring is to be installed if the raceway is more than 50 feet in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 150 feet in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 200 pounds per square inch tensile strength. Not less than 10 inches of slack shall be left at each end of the pull wire.

3.2.1.2 Conduit Stub-Ups

Where conduits are to be stubbed up through concrete floors, a short elbow shall be installed below grade to transition from the horizontal run of conduit to a vertical run. A conduit coupling fitting, threaded on the inside shall be installed, to allow terminating the conduit flush with the finished floor. Wiring shall be extended in rigid threaded conduit to equipment, except that where required, flexible conduit may be used 6 inches above the floor. Empty or spare conduit stub-ups shall be plugged flush with the finished floor with a threaded, recessed plug.

3.2.1.3 Below Slab-on-Grade or in the Ground

Electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel. Rigid steel conduits installed below slab-on-grade or in the earth shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

3.2.1.4 Installing in Slabs Including Slabs on Grade

Conduit installed in slabs-on-grade shall be rigid steel. Conduits shall be installed as close to the middle of concrete slabs as practicable without disturbing the reinforcement. Outside diameter shall not exceed 1/3 of the slab thickness and conduits shall be spaced not closer than 3 diameters on centers except at cabinet locations where the slab thickness shall be increased as approved by the Contracting Officer. Where conduit is run parallel to reinforcing steel, the conduit shall be spaced a minimum of one conduit diameter away but not less than one inch from the reinforcing steel.

3.2.1.5 Changes in Direction of Runs

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be

avoided where possible. Lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment shall be prevented during the course of construction. Clogged raceways shall be cleared of obstructions or shall be replaced.

3.2.1.6 Supports

Metallic conduits and tubing, and the support system to which they are attached, shall be securely and rigidly fastened in place to prevent vertical and horizontal movement at intervals of not more than 10 feet and within 3 feet of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, beam clamps, or ceiling trapeze. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structure. Loads shall not be applied to joist bridging. Attachment shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Cutting the main reinforcing bars in reinforced concrete beams or joists shall be avoided when drilling holes for support anchors. Holes drilled for support anchors, but not used, shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Raceways shall not be supported using wire or nylon ties. Raceways shall be independently supported from the structure. Upper raceways shall not be used as a means of support for lower raceways. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Cables and raceways shall not be supported by ceiling grids. Except where permitted by NFPA 70, wiring shall not be supported by ceiling support systems. Conduits shall be fastened to sheet-metal boxes and cabinets with two locknuts where required by NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

3.2.1.7 Exposed Raceways

Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Raceways under raised floors and above accessible ceilings shall be considered as exposed installations in accordance with NFPA 70 definitions.

3.2.1.8 Communications Raceways

Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirement that no length of run shall exceed 50 feet for 1/2 inch and 3/4 inch sizes, and 100 feet for 1 inch or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether

or not indicated. Inside radii of bends in conduits of 1 inch size or larger shall not be less than ten times the nominal diameter.

3.2.2 Cables and Conductors

Installation shall conform to the requirements of NFPA 70. Covered, bare or insulated conductors of circuits rated over 600 volts shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 600 volts or less.

3.2.2.1 Sizing

Unless otherwise noted, all sizes are based on copper conductors and the insulation types indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 100 feet long and of 277 volts more than 230 feet long, from panel to load center, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG. Class 3 low-energy, remote-control and signal circuits shall be not less than No. 22 AWG.

3.2.2.2 Use of Aluminum Conductors in Lieu of Copper

Aluminum conductors shall not be used.

3.2.2.3 Cable Splicing

Splices shall be made in an accessible location. Crimping tools and dies shall be approved by the connector manufacturer for use with the type of connector and conductor.

- a. Copper Conductors, 600 Volt and Under: Splices in conductors No. 10 AWG and smaller diameter shall be made with an insulated, pressure-type connector. Splices in conductors No. 8 AWG and larger diameter shall be made with a solderless connector and insulated with tape or heat-shrink type insulating material equivalent to the conductor insulation.
- b. Greater Than 600 Volt: Cable splices shall be made in accordance with the cable manufacturer's recommendations and Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.2.2.4 Conductor Identification and Tagging

Power, control, and signal circuit conductor identification shall be provided within each enclosure where a tap, splice, or termination is made.

Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

- a. Color coding shall be provided for service, feeder, branch, and ground conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in the same raceway or box, other neutral shall be white with colored (not green) stripe. The color coding for 3-phase and single-phase low voltage systems shall be as follows:

120/208-volt, 3-phase: Black(A), red(B), and blue(C).
277/480-volt, 3-phase: Brown(A), orange(B), and yellow(C).
120/240-volt, 1-phase: Black and red.

- b. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 3 inches of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer.
- c. Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

3.3 BOXES AND SUPPORTS

Boxes shall be provided in the wiring or raceway systems where required by NFPA 70 for pulling of wires, making connections, and mounting of devices or fixtures. Pull boxes shall be furnished with screw-fastened covers. Indicated elevations are approximate, except where minimum mounting heights for hazardous areas are required by NFPA 70. Unless otherwise indicated, boxes for wall switches shall be mounted 48 inches above finished floors. Switch and outlet boxes located on opposite sides of fire rated walls shall be separated by a minimum horizontal distance of 24 inches. The total combined area of all box openings in fire rated walls shall not exceed 100 square inches per 100 square feet. Maximum box areas for individual boxes in fire rated walls vary with the manufacturer and shall not exceed the maximum specified for that box in UL Elec Const Dir. Only boxes listed in UL Elec Const Dir shall be used in fire rated walls.

3.3.1 Box Applications

Each box shall have not less than the volume required by NFPA 70 for number of conductors enclosed in box. Boxes for metallic raceways shall be listed for the intended use when located in normally wet locations, when flush or surface mounted on outside of exterior surfaces, or when located in hazardous areas. Boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. Boxes for

mounting lighting fixtures shall be not less than 4 inches square, or octagonal, except smaller boxes may be installed as required by fixture configuration, as approved. Cast-metal boxes with 3/32 inch wall thickness are acceptable. Large size boxes shall be NEMA 1 inside and 3R outside or as shown. Boxes in other locations shall be sheet steel except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit and tubing or nonmetallic sheathed cable system, when permitted by NFPA 70. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers.

3.3.2 Brackets and Fasteners

Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screw or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. Penetration of more than 1-1/2 inches into reinforced-concrete beams or more than 3/4 inch into reinforced-concrete joists shall avoid cutting any main reinforcing steel. The use of brackets which depend on gypsum wallboard or plasterboard for primary support will not be permitted. In partitions of light steel construction, bar hangers with 1 inch long studs, mounted between metal wall studs or metal box mounting brackets shall be used to secure boxes to the building structure. When metal box mounting brackets are used, additional box support shall be provided on the side of the box opposite the brackets. This additional box support shall consist of a minimum 12 inch long section of wall stud, bracketed to the opposite side of the box and secured by two screws through the wallboard on each side of the stud. Metal screws may be used in lieu of the metal box mounting brackets.

3.3.3 Mounting in Walls, Ceilings, or Recessed Locations

In walls or ceilings of concrete, tile, or other non-combustible material, boxes shall be installed so that the edge of the box is not recessed more than 1/4 inch from the finished surface. Boxes mounted in combustible walls or ceiling material shall be mounted flush with the finished surface. The use of gypsum or plasterboard as a means of supporting boxes will not be permitted. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be mounted flush with the top of a block to minimize cutting of the blocks, and boxes shall be located horizontally to avoid cutting webs of block. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided.

3.3.4 Installation in Overhead Spaces

In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal

boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 24 inches from the box.

3.4 DEVICE PLATES

One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having rounded or beveled edges. Plates on finished walls shall be of steel with baked enamel finish. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1/16 inch. The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and provided with a hinged, gasketed cover, unless otherwise specified.

3.5 RECEPTACLES

3.5.1 Single and Duplex, 20-ampere, 125 volt

Single and duplex receptacles shall be rated 20 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of brown to match color of switch handles in the same room or to harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Only the top receptacle of a duplex receptacle shall be wired for switching application. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided as required by NFPA 70 and as indicated on the drawings.

3.5.2 Weatherproof Applications

Weatherproof receptacles shall be suitable for the environment, damp or wet as applicable, and the housings shall be labeled to identify the allowable use. Receptacles shall be marked in accordance with UL 514A for the type of use indicated; "Damp locations", "Wet Locations", "Wet Location Only When Cover Closed". Assemblies shall be installed in accordance with the manufacturer's recommendations.

3.5.2.1 Damp Locations

Receptacles in damp locations shall be mounted in an outlet box with a

gasketed, weatherproof, cast-metal cover plate (device plate, box cover) and a gasketed cap (hood, receptacle cover) over each receptacle opening. The cap shall be either a screw-on type permanently attached to the cover plate by a short length of bead chain or shall be a flap type attached to the cover with a spring loaded hinge.

3.5.2.2 Wet and Corrosive Locations

Receptacles in wet and corrosive locations shall be installed in an assembly rated for such use whether the plug is inserted or withdrawn, unless otherwise indicated. In a duplex installation, the receptacle cover shall be configured to shield the connections whether one or both receptacles are in use. Assemblies which utilize a self-sealing boot or gasket to maintain wet location rating shall be furnished with a compatible plug at each receptacle location and a sign notifying the user that only plugs intended for use with the sealing boot shall be connected during wet conditions.

3.5.3 Special-Purpose or Heavy-Duty Receptacles

Special-purpose or heavy-duty receptacles shall be of the type and of ratings and number of poles indicated or required for the anticipated purpose. Contact surfaces may be either round or rectangular. One appropriate straight or angle-type plug shall be furnished with each receptacle. Locking type receptacles, rated 30 amperes or less, shall be locked by rotating the plug. Locking type receptacles, rated more than 50 amperes, shall utilize a locking ring.

3.6 WALL SWITCHES

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall be brown. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than one switch shall be installed in a single-gang position. Switches shall be rated 20-ampere 277-volt for use on alternating current only. Pilot lights indicated shall consist of yoke-mounted candelabra-base sockets rated at 75 watts, 125 volts, and fitted with glass or plastic jewels. A clear 6-watt lamp shall be furnished and installed in each pilot switch. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be red. Dimming switches shall be solid-state flush mounted, sized for the loads.

3.7 PANELBOARDS AND LOADCENTERS

Circuit breakers and switches used as a motor disconnecting means shall be capable of being locked in the open position. Door locks shall be keyed alike. Nameplates shall be as approved. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering. Busses shall be copper.

3.7.1 Loadcenters

Loadcenters shall not be used on this project.

3.7.2 Panelboards

Panelboards shall be circuit breaker switch equipped as indicated on the drawings and described in Section 16403.

3.8 FUSES

Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilize fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination. Time-delay and non-time-delay options shall be as specified.

3.8.1 Cartridge Fuses; Noncurrent-Limiting Type

Cartridge fuses of the noncurrent-limiting type shall be Class H, nonrenewable, dual element, time lag type and shall have interrupting capacity of 10,000 amperes. At 500 percent current, cartridge fuses shall not blow in less than 10 seconds.

3.9 MOTORS

Each motor shall conform to the hp and voltage ratings indicated, and shall have a service factor and other characteristics that are essential to the proper application and performance of the motors under conditions shown or specified. Three-phase motors for use on 3-phase 208-volt systems shall have a nameplate rating of 200 volts. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40 degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual horsepower ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

3.10 TRANSFORMER INSTALLATION

Three-phase transformers shall be connected only in a delta-wye. "T" connections may be used for transformers rated at 15 kVA or below. Dry-type transformers shown located within 5 feet of the exterior wall shall be provided in a weatherproof enclosure. Transformers to be located within the building may be provided in the manufacturer's standard, ventilated indoor enclosure designed for use in 40 degrees C ambient temperature, unless otherwise indicated.

3.11 LIGHTING FIXTURES, LAMPS AND BALLASTS

This paragraph shall cover the installation of lamps, lighting fixtures and ballasts in interior or building mounted applications.

3.11.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps installed and used for working light during construction shall be replaced prior to turnover to the Government if more than 15% of their rated life has been used. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer. 10% spare lamps of each type, from the original manufacturer, shall be provided.

3.11.2 Lighting Fixtures

Fixtures shall be as shown and shall conform to the following specifications and shall be as detailed on the drawings. Illustrations shown on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar designs and equivalent energy efficiency, light distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved. In suspended acoustical ceilings with fluorescent fixtures, the fluorescent emergency light fixtures shall be furnished with self-contained battery packs.

3.11.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

3.11.2.2 Ceiling Fixtures

Ceiling fixtures shall be coordinated with and suitable for installation in, on or from the ceiling as shown. Installation and support of fixtures shall be in accordance with NFPA 70 and manufacturer's recommendations. Where seismic requirements are specified herein, fixtures shall be supported as shown or specified. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling, in conformance with UL Elec Const Dir. Surface-mounted fixtures shall be suitable for fastening to the ceiling panel structural supports.

3.11.2.3 Fixtures for Installation in Grid Type Ceilings

Fixtures for installation in grid type ceilings which are smaller than a full tile shall be centered in the tile. 1 by 4 foot fixtures shall be mounted along the grid rail as shown. Work above the ceiling shall be coordinated among the trades to provide the lighting layout shown.

Fixtures mounted to the grid shall have trim exactly compatible with the grid. Contractor shall coordinate trims with ceiling trades prior to ordering fixtures. Metric fixtures shall be designed to fit the metric grid specified. Fixtures in continuous rows shall be coordinated between trades prior to ordering. Fixtures shall be mounted using independent supports capable of supporting the entire weight of the fixture. No fixture shall rest solely on the ceiling grid. Recessed fixtures installed in seismic areas should be installed utilizing specially designed seismic clips. Junction boxes shall be supported at four points.

3.11.2.4 Suspended Fixtures

Suspended fixtures shall be provided with swivel hangers or hand-straightens so that they hang plumb. Pendants, rods, or chains 4 feet or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degrees of separation. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 10 feet or as recommended by the manufacturer, whichever is less. In general, mount fixture between 12'6" and 13' above finished floor unless noted otherwise.

Suspended fixtures installed in seismic areas shall have 45% swivel hangers and shall be located with no obstructions within the 45% range in all directions. The stem, canopy and fixture shall be capable of 45% swing.

3.11.3 Ballasts

Remote type ballasts or transformers, where indicated, shall be mounted in a well ventilated, easily accessible location, within the maximum operating distance from the lamp as designated by the manufacturer.

3.11.4 Emergency Light Sets

Emergency light sets shall conform to UL 924 with the number of heads as indicated. Sets shall be permanently connected to the wiring system by conductors installed in short lengths of flexible conduit.

3.12 BATTERY CHARGERS

Battery chargers shall be installed in conformance with NFPA 70.

3.13 EQUIPMENT CONNECTIONS

Wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the

specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits 6 feet or less in length shall be provided to all electrical equipment subject to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

3.13.1 Motors and Motor Control

Motors, motor controls, and motor control centers shall be installed in accordance with NFPA 70, the manufacturer's recommendations, and as indicated. Wiring shall be extended to motors, motor controls, and motor control centers and terminated.

3.13.2 Installation of Government-Furnished Equipment

Wiring shall be extended to the equipment and terminated.

3.14 CIRCUIT PROTECTIVE DEVICES

The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they will function properly prior to the initial energization of the new power system under actual operating conditions.

3.15 PAINTING AND FINISHING

Field-applied paint on exposed surfaces shall be provided under Section 09900 PAINTING, GENERAL.

3.16 REPAIR OF EXISTING WORK

The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Government.

3.17 FIELD TESTING

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 14 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspection recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the Contractor.

3.17.1 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.17.2 Cable Tests

The Contractor shall be responsible for identifying all equipment and devices that could be damaged by application of the test voltage and ensuring that they have been properly disconnected prior to performing insulation resistance testing. An insulation resistance test shall be performed on all low and medium voltage cables after the cables are installed in their final configuration and prior to energization. The test voltage shall be 500 volts DC applied for one minute between each conductor and ground and between all possible combinations of conductors. The minimum value of resistance shall be:

$$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 1000 / (\text{length of cable in feet})$$

Each cable failing this test shall be repaired or replaced. The repaired cable system shall then be retested until failures have been eliminated.

3.17.2.1 Low Voltage Cable Tests

- a. Continuity test.
- b. Insulation resistance test.

3.17.3 Motor Tests

- a. Phase rotation test to ensure proper directions.
- b. Operation and sequence of reduced voltage starters.
- c. High potential test on each winding to ground.
- d. Insulation resistance of each winding to ground.
- e. Vibration test.
- f. Dielectric absorption test on motor.

3.17.4 Dry-Type Transformer Tests

The following field tests shall be performed on all dry-type transformers 5 kVA and above.

- a. Insulation resistance test phase-to-ground, each phase.
- b. Turns ratio test.

3.17.5 Circuit Breaker Tests

The following field tests shall be performed on circuit breakers.

3.17.5.1 Circuit Breakers, Molded Case

- a. Insulation resistance test phase-to-phase, all combinations.
- b. Insulation resistance test phase-to-ground, each phase.
- c. Closed breaker contact resistance test.
- d. Manual operation of the breaker.

3.18 OPERATING TESTS

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph FIELD TEST REPORTS.

3.19 FIELD SERVICE

3.19.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 2 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations.

3.19.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of equipment, assist in the performance of the onsite tests, oversee initial operations, and instruct personnel as to the operational and maintenance features of the equipment.

3.20 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16528

EXTERIOR LIGHTING INCLUDING SECURITY

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 Lighting System
 - 1.2.2 Electrical Requirements
 - 1.2.3 Nameplates
 - 1.2.4 Standard Products
- 1.3 CORROSION PROTECTION
 - 1.3.1 Aluminum Materials
 - 1.3.2 Ferrous Metal Materials
 - 1.3.2.1 Hardware
 - 1.3.2.2 Equipment
 - 1.3.3 Finishing
- 1.4 SUBMITTALS

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCT
- 2.2 BRACKET ARMS
 - 2.2.1 Floodlight Brackets
- 2.3 CABLE
 - 2.3.1 Insulated Cable
- 2.4 CABLE SPLICES AND CONNECTORS
- 2.5 CABLE BOXES
- 2.6 MANHOLES, HANDHOLES, AND PULLBOXES
- 2.7 CONDUIT, DUCTS AND FITTINGS
 - 2.7.1 Conduit, Rigid Steel
 - 2.7.2 Conduit Coatings
 - 2.7.3 Conduit Fittings and Outlets
 - 2.7.3.1 Boxes, Metallic Outlets
 - 2.7.3.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers
 - 2.7.3.3 Boxes, Switch (Enclosed), Surface Mounted
 - 2.7.3.4 Fittings for Conduit and Outlet Boxes
 - 2.7.3.5 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing
 - 2.7.4 Non-Metallic Duct
- 2.8 POLES
 - 2.8.1 Steel Poles
 - 2.8.2 Anchor Bolts
- 2.9 POLE LINE HARDWARE
- 2.10 ELECTRICAL ENCLOSURES

- 2.10.1 Interior Enclosures
- 2.10.2 Exposed-to-Weather Enclosures
- 2.11 ILLUMINATION
 - 2.11.1 General Lighting
- 2.12 LAMPS AND BALLASTS, HIGH INTENSITY DISCHARGE (HID) SOURCES
 - 2.12.1 High-Pressure Sodium
 - 2.12.2 Metal-Halide
- 2.13 LAMPS, INCANDESCENT
- 2.14 LAMPS, FLUORESCENT
- 2.15 LUMINAIRE COMPONENTS
- 2.16 LIGHTING CONTROL EQUIPMENT
 - 2.16.1 Photo-Control Devices
 - 2.16.2 Timer Control Switches
 - 2.16.3 Manual Control Switches
 - 2.16.4 Magnetic Contactor
- 2.17 PHOTOMETRIC DISTRIBUTION CLASSIFICATION
- 2.18 LUMINAIRES, FLOODLIGHTING
 - 2.18.1 HID and Incandescent
 - 2.18.2 Fluorescent
- 2.19 FIXTURES
 - 2.19.1 Accessories

PART 3 EXECUTION

- 3.1 GENERAL
 - 3.1.1 Current Site Conditions
- 3.2 ENCLOSURE PENETRATIONS
- 3.3 PREVENTION OF CORROSION
 - 3.3.1 Aluminum
 - 3.3.2 Steel Conduits
 - 3.3.3 Cold Galvanizing
- 3.4 CABLE INSTALLATION
 - 3.4.1 Splices
 - 3.4.2 Installation in Duct
 - 3.4.3 Direct Burial
 - 3.4.3.1 Requirements for Installation in Duct
 - 3.4.3.2 Location of Cable Splices
 - 3.4.3.3 Markers
 - 3.4.3.4 Warning Tape
- 3.5 CONNECTIONS TO BUILDINGS
- 3.6 POLE INSTALLATION
 - 3.6.1 Pole Brackets
 - 3.6.2 Concrete Foundations
 - 3.6.3 Rigid Steel Conduit Ells
 - 3.6.4 Steel Pole Installation
 - 3.6.4.1 Cast-In-Place Foundations
 - 3.6.4.2 Power-Installed Screw Foundations
- 3.7 LIGHTING
 - 3.7.1 Lamps
 - 3.7.2 Fixture Installation
 - 3.7.2.1 Accessories
- 3.8 LIGHTING CONTROL SYSTEM
 - 3.8.1 Photo-Control
 - 3.8.2 Time Control Switches

- 3.8.3 Magnetic Contactors
- 3.9 TESTS
 - 3.9.1 Operating Test

-- End of Section Table of Contents --

SECTION 16528

EXTERIOR LIGHTING INCLUDING SECURITY
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO LTS-3 (1994) Standard Specifications for
Structural Supports for Highway Signs,
Luminaires and Traffic Signals

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C78.1 (1991; C78.1a; R 1996) Fluorescent Lamps -
Rapid-Start Types - Dimensional and
Electrical Characteristics

ANSI C78.40 (1992) Specifications for Mercury Lamps

ANSI C78.1350 (1990) Electric Lamps - 400-Watt,
100-Volt, S51 Single-Ended High-Pressure
Sodium Lamps

ANSI C78.1351 (1989) Electric Lamps - 250-Watt, 100-Volt
S50 Single-Ended High-Pressure Sodium Lamps

ANSI C78.1352 (1990) Electric Lamps - 1000-Watt,
250-Volt, S52 Single-Ended High-Pressure
Sodium Lamps

ANSI C78.1355 (1989) Electric Lamps - 150-Watt, 55-Volt
S55 High-Pressure Sodium Lamps

ANSI C78.1375 (1996) 400-Watt, M59 Single-Ended
Metal-Halide Lamps

ANSI C78.1376 (1996) 1000-Watt, M47 Metal-Halide Lamps

ANSI C80.1 (1995) Rigid Steel Conduit - Zinc Coated

ANSI C82.4 (1992) Ballasts for

	High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
ANSI C119.1	(1986; R 1997) Sealed Insulated Underground Connector Systems Rated 600 Volts
ANSI C135.1	(1979) Galvanized Steel Bolts and Nuts for Overhead Line Construction
ANSI C135.14	(1979) Staples with Rolled or Slash Points for Overhead Line Construction
ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction
ANSI C136.2	(1996) Luminaires, Voltage Classification Roadway Lighting Equipment
ANSI C136.3	(1995) Roadway Lighting Equipment-Luminaire Attachments
ANSI C136.6	(1997) Roadway Lighting Equipment - Metal Heads and Reflector Assemblies - Mechanical and Optical Interchangeability
ANSI C136.9	(1990) Roadway Lighting - Socket Support Assemblies for Use in Metal Heads - Mechanical Interchangeability
ANSI C136.10	(1996) Roadway Lighting- Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing
ANSI C136.11	(1995) Multiple Sockets for Roadway Lighting Equipment
ANSI C136.15	(1986) Roadway Lighting, High-Intensity-Discharge and Low-Pressure Sodium Lamps in Luminaires -
ANSI C136.20	(1990) Roadway Lighting Equipment - Fiber Reinforced Plastic (FRP) Fiber Lighting Poles
ANSI O5.1	(1992) Specifications and Dimensions for Wood Poles

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997a) Carbon Structural Steel
ASTM A 48	(1994a) Gray Iron Castings

ASTM A 123/A 123M	(1997a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 575	(1996) Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 576	(1990b; R 1995) Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM B 2	(1994) Medium-Hard-Drawn Copper Wire
ASTM B 8	(1995) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA RP-8	(1983; R 1993) Roadway Lighting
------------	---------------------------------

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits
IEEE C136.13	(1987; R 1997) Metal Brackets for Wood Poles
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(1993) Industrial Control and Systems
NEMA ICS 2	(1993) Industrial Control and Systems

Controllers, Contactors, and Overload
Relays Rated Not More Than 2,000 Volts AC
or 750 Volts DC Assemblies

NEMA ICS 6	(1993) Industrial Control and Systems, Enclosures
NEMA OS 1	(1996) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA OS 2	(1986; Errata Aug 1986; R 1991) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA RN 1	(1989) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA TC 9	(1990) Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
---------	---------------------------------

UNDERWRITERS LABORATORIES (UL)

UL 6	(1997) Rigid Metal Conduit
UL 44	(1997; Rev Mar 1999) Rubber-Insulated Wires and Cables
UL 98	(1994; Rev thru Jun 1998) Enclosed and Dead-Front Switches
UL 467	(1993; Rev Aug 1996) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru Dec 1998) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; Rev Jun 1997) Wire Connections for Use with Aluminum Conductors
UL 506	(1994; Rev thru Oct 1997) Specialty Transformers
UL 514A	(1996; R Jul 1998) Metallic Outlet Boxes
UL 514B	(1996; R Oct 1998) Fittings for Conduit

and Outlet Boxes

UL 514C	(1996; R Sep 1998) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 651	(1995; Rev thru Oct 1998) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(1995; Rev thru Apr 1998) Type EB and A Rigid PVC Conduit and HDPE Conduit
UL 854	(1996; Rev Apr 1998) Service-Entrance Cables
UL 870	(1995; Rev Jun 1998) Wireways, Auxiliary Gutters, and Associated Fittings
UL 886	(1994; Rev thru Apr 1999) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
UL 1029	(1994; Rev thru Dec 1997) High-Intensity-Discharge Lamp Ballasts
UL 1449	(1996; Rev thru Oct 1998) Transient Voltage Surge Suppressors
UL 1571	(1995; Rev thru Jun 1997) Incandescent Lighting Fixtures
UL 1572	(1995; Rev thru Jun 1997) High Intensity Discharge Lighting Fixtures

1.2 SYSTEM DESCRIPTION

1.2.1 Lighting System

The lighting system shall be configured as specified and shown. The system shall include all fixtures, hardware, poles, cables, connectors, adapters and appurtenances needed to provide a fully functional lighting system.

1.2.2 Electrical Requirements

The equipment shall operate from a voltage source as shown, plus or minus 10 percent, and 60 Hz, plus or minus 2 percent.

1.2.3 Nameplates

Each major component of equipment shall have a nonferrous metal or engraved plastic nameplate which shall show, as a minimum, the manufacturer's name and address, the catalog or style number, the electrical rating in volts, and the capacity in amperes or watts.

1.2.4 Standard Products

Materials and equipment shall be standard products of manufacturer regularly engaged in the manufacture of such products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.3 CORROSION PROTECTION

1.3.1 Aluminum Materials

Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to UL 486B shall be used.

1.3.2 Ferrous Metal Materials

1.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

1.3.2.2 Equipment

Equipment and component items, including but not limited to metal poles and ferrous metal luminaires not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall have a rating of not less than 7 in accordance with TABLE 1, (procedure A) of ASTM D 1654. Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

1.3.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory, shall be as specified in Section 09900 PAINTING, GENERAL.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment and Materials; FIO.

Data published by the manufacturer of each item on the list of equipment and material, to permit verification that the item proposed is of the

correct size, properly rated or applied, or is otherwise suitable for the application and fully conforms to the requirements specified.

SD-19 Operation and Maintenance Manuals

Lighting System; FIO.

A draft copy of the operation and maintenance manuals, prior to beginning the tests for use during site testing. Final copies of the manuals as specified bound in hardback, loose-leaf binders, within 30 days after completing the field test. The draft copy used during site testing shall be updated with any changes required, prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the field test shall include modifications made during installation checkout and acceptance.

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 BRACKET ARMS

2.2.1 Floodlight Brackets

Floodlight brackets shall be coordinated with the floodlight support provided.

2.3 CABLE

The Contractor shall provide all wire and cable not indicated as government furnished equipment. Wire and cable components shall be able to withstand the jobsite environment for a minimum of 20 years.

2.3.1 Insulated Cable

Cable shall be type USE conforming to UL 854, with copper conductors and type RHW or XHHW insulation conforming to UL 44, and shall include green ground conductor. Cable shall be provided with insulation of a thickness not less than that given in column A of TABLE 15.1 of UL 854. Cable shall be rated 600 volts. Parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors

larger than No. 8 AWG shall be stranded.

2.4 CABLE SPLICES AND CONNECTORS

Cable splices and connectors shall conform to UL 486A. Underground splices and connectors shall also conform to the requirements of ANSI C119.1.

2.5 CABLE BOXES

Boxes and covers shall be made of cast iron with zinc coated or aluminized finish, and shall be of the sizes indicated on drawings. The minimum inside dimensions shall be not less than 12 inches square by 6 inches deep and not less than required to house the cable splice. A suitable gasket shall be installed between the box and cover for watertightness. A sufficient number of screws shall be installed to hold the cover in place along the entire surface of contact. Grounding lugs shall be provided.

2.6 MANHOLES, HANDHOLES, AND PULLBOXES

Manholes, handholes, and pullboxes shall be as indicated. Strength of manholes, handholes, and pullboxes and their frames and covers shall conform to the requirements of IEEE C2. Precast concrete manholes shall have the required strength established by ASTM C 478. Frames and covers for manholes shall be made of gray cast iron or cast steel. A machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48, Class 30B, minimum. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least 10,000 psi and a flexural strength of at least 5,000 psi. Pullbox and handhole covers in parking lots, sidewalks, and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

A sufficient number of tamperproof bolts shall be installed to hold the cover firmly in place along the entire surface of contact; a tool for the tamperproof bolts shall be furnished.

2.7 CONDUIT, DUCTS AND FITTINGS

2.7.1 Conduit, Rigid Steel

Rigid steel conduit shall conform to ANSI C80.1 and UL 6.

2.7.2 Conduit Coatings

Underground metallic conduit and fittings shall be coated with a plastic resin system conforming to NEMA RN 1, Type 40. Epoxy systems may also be used.

2.7.3 Conduit Fittings and Outlets

2.7.3.1 Boxes, Metallic Outlets

NEMA OS 1 and UL 514A.

2.7.3.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

NEMA OS 2 and UL 514C.

2.7.3.3 Boxes, Switch (Enclosed), Surface Mounted

UL 98.

2.7.3.4 Fittings for Conduit and Outlet Boxes

UL 514B.

2.7.3.5 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

2.7.4 Non-Metallic Duct

Non-metallic duct lines and fittings utilized for underground installation shall be suitable for the application. Duct shall be thick-wall, single, round-bore type. Material of one type shall be used. Schedule 40 polyvinyl chloride (PVC) shall conform to UL 651. Plastic utility duct and fittings manufactured without a UL label or listing shall be provided with a certification as follows: "The materials are suitable for use with 167 degree F wiring. No reduction of properties in excess of that specified for materials with a UL label or listing will be experienced if samples of the finished product are operated continuously under the normal conditions that produce the highest temperature in the duct."

2.8 POLES

Metal poles shall be the pole manufacturer's standard design for supporting the number of fixtures indicated. Poles shall be designed for a wind velocity of 110 mph at the base of the pole, for a wind gust factor of 1.3, and for the height and drag factors recommended by AASHTO LTS-3. The effective projected area of luminaires and other pole-mounted devices shall be taken into account in pole design. Poles shall have grounding provisions. The type of pole shaft material provided shall not be mixed on any project. Grounding connection shall be provided near the bottom of each metal pole and at each concrete pole anchor base. Scratched, stained, chipped, or dented poles shall not be installed.

2.8.1 Steel Poles

Steel poles shall be hot-dip galvanized in accordance with ASTM A 123/A 123M and shall not be painted. Poles shall have tapered tubular members, either round in cross-section or polygonal. Pole shafts shall be one piece. Poles shall be welded construction with no bolts, rivets, or other means of fastening except as specifically approved. Pole markings shall be approximately 3 to 4 feet above grade and shall include manufacturer, year of manufacture, top and bottom diameters, length, and a loading tree. Attachment requirements shall be provided as indicated, including grounding provisions. Climbing facilities are not required. Bases shall be of the

anchor bolt-mounted type.

2.8.2 Anchor Bolts

Anchor bolts shall be the pole manufacturer's standard, but not less than necessary to meet the pole wind and ice loading, herein and other specified design requirements.

2.9 POLE LINE HARDWARE

Zinc coated hardware shall conform to ANSI C135.1 and ANSI C135.14, and steel hardware material shall conform to ASTM A 575 and ASTM A 576. Hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M.

2.10 ELECTRICAL ENCLOSURES

The Contractor shall provide metallic enclosures as needed to house the lighting equipment. Enclosures shall conform to NEMA ICS 6 and NEMA 250. Enclosures shall be provided with lockable or padlock handles. Keys for lockable enclosures shall be delivered to the Contracting Officer. The enclosures shall be as specified or as shown on the drawings.

2.10.1 Interior Enclosures

Enclosures to house lighting equipment in an interior environment shall meet the requirements of a NEMA 12 enclosure as defined in NEMA 250.

2.10.2 Exposed-to-Weather Enclosures

Enclosures to house lighting equipment in an outdoor environment shall meet the requirements of a NEMA 4 enclosure as defined in NEMA 250.

2.11 ILLUMINATION

2.11.1 General Lighting

Luminaires, ballasts, lamps, and control devices required for general area and lighting, including floodlighting shall be in accordance with sheet E10.0

2.12 LAMPS AND BALLASTS, HIGH INTENSITY DISCHARGE (HID) SOURCES

2.12.1 High-Pressure Sodium

Lamps shall conform to ANSI C78.1350. Ballasts shall conform to ANSI C82.4, or UL 1029. High-pressure sodium lamps shall be clear.

2.12.2 Metal-Halide

Lamps shall be made by a manufacturer with not less than 5 years experience in making metal-halide lamps. Metal-halide lamps shall conform to ANSI C78.1375 or ANSI C78.1376. Ballasts shall conform to ANSI C82.4 or UL 1029.

2.13 LAMPS, INCANDESCENT

Incandescent lamps shall conform to UL 1571 and shall be rated for 120 volt operation unless otherwise specified.

2.14 LAMPS, FLUORESCENT

Fluorescent lamps shall have standard cool-white color characteristics and shall not require starter switches. The lamps shall be of the rapid-start type.

2.15 LUMINAIRE COMPONENTS

Luminaire components shall conform to the following: attachments, ANSI C136.3; voltage classification, ANSI C136.2; field identification marking, ANSI C136.15; interchangeability, ANSI C136.6 and ANSI C136.9; and sockets, ANSI C136.11.

2.16 LIGHTING CONTROL EQUIPMENT

2.16.1 Photo-Control Devices

Photo-control devices shall conform to ANSI C136.10. Each photo-control element shall be a replaceable, weatherproof, plug-in or twist-lock assembly adjustable operation range of approximately 0.5 to 5.0 foot-candles. Luminaires shall be equipped with weatherproof plug-in or twist-lock receptacle to receive the photo-control element.

2.16.2 Timer Control Switches

Astronomic dial type arranged to turn "ON" at sunset, and turn "OFF" at a pre-determined time between 2030 hours and 0230 hours or sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise shall be provided. A switch rated 120 volts, having automatically wound spring mechanism to maintain accurate time for a minimum of 7 hours following a power failure shall be provided. A time switch with a manual on-off bypass switch shall be provided. Housing for the time switch shall be a surface mounted, NEMA 1 (indoor) enclosure conforming to NEMA ICS 6.

2.16.3 Manual Control Switches

Manual control switches shall conform to UL 98. The switches shall be the heavy-duty type and shall be suitable for operation on a 120 volt, 60 Hz system. The number of poles and ampere rating shall be as indicated. Switch construction shall be such that a screwdriver will be required to open the switch door when the switch is on. The selector switch shall have a minimum of three positions: ON, OFF, and AUTOMATIC. The automatic selection shall be used when photoelectric or timer control is desired. The selector switch shall interface with the lighting system magnetic contactor and control its activity.

2.16.4 Magnetic Contactor

Magnetic contactors shall be mechanically held, electrically operated, and shall conform to NEMA ICS 1 and NEMA ICS 2. The contactor shall be

suitable for 277 or 120 volts, single phase, 60 Hz. Coil voltage shall be 120 volts. Maximum continuous ampere rating and number of poles shall be as indicated on drawings. Enclosures for contactors mounted indoors shall be NEMA ICS 6, Type 1. Each contactor shall be provided with a spare, normally open auxiliary contact. Terminal lugs shall be coordinated with the wire size.

2.17 PHOTOMETRIC DISTRIBUTION CLASSIFICATION

Photometrics shall conform to IESNA RP-8.

2.18 LUMINAIRES, FLOODLIGHTING

2.18.1 HID and Incandescent

HID lighting fixtures shall conform to UL 1572. Incandescent lighting fixtures shall conform to UL 1571.

2.18.2 Fluorescent

Fluorescent lamps shall conform to ANSI C78.1.

2.19 FIXTURES

Standard fixtures shall be as detailed on Sheet No. E10.0. Special fixtures shall be as indicated on the drawings. Illustrations shown on these sheets or on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar design, equivalent light distribution and brightness characteristics, equal finish and quality will be acceptable as approved.

2.19.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall install all system components, including government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, IEEE C2, and contract documents, and shall furnish necessary hardware, fixtures, cables, wire, connectors, interconnections, services, and adjustments required for a complete and operable system.

3.1.1 Current Site Conditions

The Contractor shall verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Government. The Contractor shall not take any corrective action without written

permission from the Government.

3.2 ENCLOSURE PENETRATIONS

Enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer, and in such a manner that the cable is not damaged.

3.3 PREVENTION OF CORROSION

3.3.1 Aluminum

Aluminum shall not be used in contact with earth or concrete, and where connected to dissimilar metal, shall be protected by approved fittings and treatment.

3.3.2 Steel Conduits

Steel conduits shall not be installed within concrete slabs-on-grade. Steel conduits installed underground or under slabs-on-grade, or penetrating slabs-on-grade, shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlap, or shall have a factory-applied plastic resin, epoxy coating. Zinc coating may be omitted from steel conduit which has a factory-applied epoxy coating.

3.3.3 Cold Galvanizing

Field welds and/or brazing on factory galvanized boxes, enclosures, conduits, etc. shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

3.4 CABLE INSTALLATION

Cable and all parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded. Each circuit shall be identified by means of fiber or nonferrous metal tags, or approved equal, in each handhole and junction box, and at each terminal.

3.4.1 Splices

Splices below grade shall be made with nonpressure-filled resin systems using transparent, interlocking, self-venting, longitudinally split plastic molds. Splices above grade shall be made with sealed insulated pressure connectors and shall provide insulation and jacket equal to that of the cable. In order to prevent moisture from entering the splice, jackets shall be cut back to expose the required length of insulation between the jacket and the tapered end of the insulation.

3.4.2 Installation in Duct

Ground and neutral conductors shall be installed in duct with the associated phase conductors. Cable splices shall be made in handholes only.

3.4.3 Direct Burial

3.4.3.1 Requirements for Installation in Duct

Cable shall be installed in duct lines. Ground and neutral conductors shall be installed in duct with the associated phase conductors.

3.4.3.2 Location of Cable Splices

Cable splices shall be installed in cable boxes or concrete handholes.

3.4.3.3 Markers

Cable and cable splice markers shall be located near the ends of cables, at each cable splice, approximately every 400 feet along the cable run, and at changes in direction of the cable run. Markers need not be placed along cables laid in relatively straight lines between lighting poles that are spaced less than 400 feet apart. Markers shall be placed approximately 2 feet to the right of the cable or cable splice when facing the longitudinal axis of the cable in the direction of the electrical load. The marker shall be concrete with a 28 day compressive strength of 2500 psi in accordance with Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The letter "C" shall be impressed in the top of each marker.

3.4.3.4 Warning Tape

Direct burial cable shall be placed below a plastic warning tape buried in the same trench or slot. A 5 mil brightly colored plastic tape, not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1 mil metallic foil core to permit easy location of the buried cable, shall be placed approximately 12 inches below finished grade.

3.5 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated and shall be properly connected to the indicated equipment. Empty conduits to the indicated equipment from a point 5 feet outside the building wall and 3 feet below finished grade are specified in Section 16415 ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed to prevent moisture or gases from entering the building.

3.6 POLE INSTALLATION

Pole lengths shall provide a luminaire mounting height of 16 feet. Luminaire mounting height may be increased by the height of the transformer base where required. Electrical cabling shall be provided to the light pole as specified in Section 16120. The mount interfaces shall have ac

power connected, and the pole wiring harness shall be connected to the luminaire. Light poles shall not be installed outside the site or inside the perimeter zone. Pole installation shall conform to the manufacturer's recommendations, NFPA 70, and IEEE C2. Poles shall be set straight and plumb.

3.6.1 Pole Brackets

Brackets shall be installed as specified by the manufacturer and as shown on drawings. Mounting hardware shall be sized appropriately to secure the mount, luminaire, and housing with wind and ice loading normally encountered at the site. Pole brackets for floodlights shall have the number of tenons indicated, arranged to provide the indicated spread between each tenon. Where indicated on drawings, adjustable heads shall be installed on the brackets to position the luminaires. Identical brackets shall be used with one type of luminaire.

3.6.2 Concrete Foundations

Concrete foundations shall have anchor bolts accurately set in the foundation using a template supplied by the pole manufacturer. Once the concrete has cured, the pole shall be set on the foundation, leveled on the foundation bolts, and secured with the holding nuts. The space between the foundation and the pole base shall be grouted. Concrete and grout work shall conform to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete shall be 3000 psi at 28 days.

3.6.3 Rigid Steel Conduit Ells

Rigid steel conduit ells shall be provided at all poles. Rigid steel conduit shall be connected to the ells and shall extend to a minimum height of 10 feet above grade. Rigid steel conduit ells shall be provided for wood poles, where required

3.6.4 Steel Pole Installation

Poles shall be mounted on cast-in-place or power-installed screw foundations. Concrete poles shall be embedded in accordance with the details shown. Conduit elbows shall be provided for cable entrances into pole interiors.

3.6.4.1 Cast-In-Place Foundations

Concrete foundations, sized as indicated, shall have anchor bolts accurately set in foundations using templates supplied by the pole manufacturer. Concrete work and grouting is specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. After the concrete has cured, pole anchor bases shall be set on foundations and leveled by shimming between anchor bases and foundations or by setting anchor bases on leveling nuts and grouting. Poles shall be set plumb. Anchor bolts shall be the manufactures standard, and not less than necessary to meet the pole wind loading and other specified design requirements.

3.6.4.2 Power-Installed Screw Foundations

Power-installed screw foundations having the required strength mounting bolt and top plate dimensions may be utilized. Screw foundations shall be of at least 1/4 inch thick structural steel conforming to ASTM A 36/A 36M and hot-dip galvanized in accordance with ASTM A 123/A 123M. Conduit slots in screw foundation shafts and top plates shall be marked to indicate orientation. Design calculations indicating adequate strength shall be approved before installation of any screw foundation.

3.7 LIGHTING

3.7.1 Lamps

Lamps of the proper type, wattage, and voltage rating shall be delivered to the project in the original containers and installed in the fixtures just before completion of the project.

3.7.2 Fixture Installation

Standard fixtures shall be installed as detailed on Sheet No. E10.0. Special fixtures shall be as indicated on drawings. Illustrations shown on these sheets or on the drawings are indicative of the general type desired and are not intended to restrict selection of fixtures to any particular manufacturer. Fixtures of similar design, equivalent light-distribution and brightness characteristics, and equal finish and quality will be acceptable as approved.

3.7.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be installed as required for proper installation.

3.8 LIGHTING CONTROL SYSTEM

3.8.1 Photo-Control

Lighting luminaires shall be controlled in banks by a single photo-control element mounted within each bank.

3.8.2 Time Control Switches

Switches shall be installed with not less than four 1/4 inch bolts. The use of sheet metal screws will not be allowed.

3.8.3 Magnetic Contactors

Terminal lugs shall be coordinated with the wire size. Switches shall be securely fastened to the supporting structure or wall using not less than four 1/4 inch bolts. The use of sheet metal screws will not be allowed.

3.9 TESTS

3.9.1 Operating Test

After the installation is completed and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements specified. The test shall be performed in the presence of the Contracting Officer. The Contractor shall furnish instruments and personnel required for the test, and the Government will furnish the necessary electric power.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16710

PREMISES DISTRIBUTION SYSTEM

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
- 1.3 ENVIRONMENTAL REQUIREMENTS
- 1.4 QUALIFICATIONS
 - 1.4.1 Minimum Contractor Qualifications
 - 1.4.2 Minimum Manufacturer Qualifications
- 1.5 SUBMITTALS
- 1.6 DELIVERY AND STORAGE
- 1.7 OPERATION AND MAINTENANCE MANUALS
- 1.8 RECORD KEEPING AND DOCUMENTATION
 - 1.8.1 Cables
 - 1.8.2 Termination Hardware

PART 2 PRODUCTS

- 2.1 MATERIALS AND EQUIPMENT
- 2.2 UNSHIELDED TWISTED PAIR CABLE SYSTEM
 - 2.2.1 Backbone Cable
 - 2.2.2 Horizontal Cable
 - 2.2.3 Connecting Hardware
 - 2.2.3.1 Telecommunications Outlets
 - 2.2.3.2 Terminal Blocks
- 2.3 SHIELDED TWISTED PAIR CABLE SYSTEM
 - 2.3.1 Backbone Cable
 - 2.3.2 Horizontal Cable
- 2.4 TELECOMMUNICATIONS OUTLET BOXES

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Horizontal Distribution Cable
 - 3.1.2 Telecommunications Outlets
 - 3.1.2.1 Faceplates
 - 3.1.2.2 Cables
 - 3.1.2.3 Pull Cords
 - 3.1.3 Terminal Blocks
- 3.2 TERMINATION
 - 3.2.1 Unshielded Twisted Pair Cable
 - 3.2.2 Shielded Twisted Pair Cable

- 3.3 GROUNDING
- 3.4 ADMINISTRATION AND LABELING
 - 3.4.1 Labeling
 - 3.4.1.1 Labels
 - 3.4.1.2 Cable
 - 3.4.1.3 Termination Hardware
- 3.5 TESTING
 - 3.5.1 Unshielded Twisted Pair Tests
 - 3.5.2 Category 5e Circuits
 - 3.5.3 Shielded Twisted Pair

-- End of Section Table of Contents --

<MTA NAME=SUBFORMAT CONTENT=NEW>

SECTION 16710

PREMISES DISTRIBUTION SYSTEM

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

ANSI/TIA/EIA-568-A	(1995) Commercial Building Telecommunications Cabling Standard
ANSI/TIA/EIA-568-A-5	(2000) Transmission Performance Specifications for 4-pair 100 ohm Category 5E Cabling
ANSI/TIA/EIA-569-A	(1998) Commercial Building Standard for Telecommunications Pathways and Spaces
ANSI/TIA/EIA-606	(1993) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI/TIA/EIA-607	(1994) Commercial Building Grounding and Bonding Requirements for Telecommunications
TIA/EIA TSB 67	(1995) Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems

IBM CORPORATION (IBM)

IBM GA27-3361-07	(1987) LAN Cabling System - Planning and Installation
IBM GA27-3773-0	(1987) Cabling System Technical Interface Specifications

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-80-576	(1994) Communications Wire and Cable for Wiring of Premises
ICEA S-83-596	(1994) Fiber Optic Premises Distribution

Cable

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

UNDERWRITERS LABORATORY (UL)

UL 50 (1995; Rev thru Nov 1999) Enclosures for
Electrical Equipment

1.2 SYSTEM DESCRIPTION

The premises distribution system shall consist of inside-plant horizontal, riser, and backbone cables and connecting hardware to transport telephone and data (including LAN) signals between equipment items in a building.

1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

1.4 QUALIFICATIONS

1.4.1 Minimum Contractor Qualifications

All work under this section shall be performed by and all equipment shall be furnished and installed by a certified Telecommunications Contractor, hereafter referred to as the Contractor. The Contractor shall have the following qualifications in Telecommunications Systems installation:

- a. Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.
- b. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products.
- c. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.4.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of 3 years experience in producing the types of systems and equipment specified.

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Record Keeping and Documentation; FIO.

Documentation on cables and termination hardware in accordance with ANSI/TIA/EIA-606.

Manufacturer's Recommendations; FIO.

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations, prior to installation shall be provided. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

Test Plan; GA.

Test plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 60 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

Qualifications; FIO.

The qualifications of the Manufacturer, Contractor, and the Installer to perform the work specified herein. This shall include proof of the minimum qualifications specified herein.

SD-13 Certificates

Materials and Equipment; FIO.

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

Installers; GFIO.

The Contractor shall submit certification that all the installers are factory certified to install and test the provided products.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.7 OPERATION AND MAINTENANCE MANUALS

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

1.8 RECORD KEEPING AND DOCUMENTATION

1.8.1 Cables

A record of all installed cable shall be provided in hard copy format per ANSI/TIA/EIA-606.

1.8.2 Termination Hardware

A record of all installed patch panels and outlets shall be provided in hard copy format. The hardware records shall include only the required data fields per ANSI/TIA/EIA-606.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.

2.2 UNSHIELDED TWISTED PAIR CABLE SYSTEM

2.2.1 Backbone Cable

Backbone cable shall meet the requirements of ICEA S-80-576 and ANSI/TIA/EIA-568-A for Category 5 100-ohm unshielded twisted pair cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Conductors shall be solid untinned copper 22 AWG. Cable shall be rated CMR per NFPA 70.

2.2.2 Horizontal Cable

Horizontal cable shall meet the requirements of ANSI/TIA/EIA-568-A-5 for Category 5e. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMG or CMP, as appropriate, per

NFPA 70.

2.2.3 Connecting Hardware

2.2.3.1 Telecommunications Outlets

Wall outlet plates shall come equipped with two modular jacks, with the top or left jack labeled "voice" and the bottom or right jack labeled "data". Modular jacks shall be the same category as the cable they terminate and shall meet the requirements of ANSI/TIA/EIA-568-A. Modular jack pin/pair configuration shall be T568A per ANSI/TIA/EIA-568-A. Modular jacks shall be keyed. Faceplates shall be provided and shall be ivory in color, stainless steel. Outlet assemblies used in the premises distribution system shall consist of modular jacks assembled into both simplex and duplex outlet assemblies in single or double gang covers as specified in this section. The modular jacks shall conform to the requirements of ANSI/TIA/EIA-568-A, and shall be rated for use with Category 5e cable in accordance with ANSI/TIA/EIA-568-A-5 and shall meet the Link Test parameters as listed in TIA/EIA TSB 67 and supplemented by ANSI/TIA/EIA-568-A-5.

2.2.3.2 Terminal Blocks

Terminal blocks shall be wall mounted wire termination units consisting of insulation displacement connectors mounted in plastic blocks, frames or housings. Blocks shall be type 110 which meet the requirements of ANSI/TIA/EIA-568-A, and shall be rated for use with Category 5e cable in accordance with ANSI/TIA/EIA-568-A-5 and shall meet the Link Test parameters as listed in TIA/EIA TSB 67 and supplemented by ANSI/TIA/EIA-568-A-5. Blocks shall be mounted on standoffs and shall include cable management hardware. Insulation displacement connectors shall terminate 22 or 24 gauge solid copper wire as a minimum, and shall be connected in pairs so that horizontal cable and connected jumper wires are on separate connected terminals.

2.3 SHIELDED TWISTED PAIR CABLE SYSTEM

2.3.1 Backbone Cable

Backbone cable shall meet the requirements of IBM GA27-3773-0 for 150 ohm Shielded Twisted Pair Cable and shall meet or exceed IBM performance requirements for Type 1A cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMP per NFPA 70.

2.3.2 Horizontal Cable

Horizontal cable shall meet the requirements of IBM GA27-3773-0 for 150 ohm Shielded Twisted Pair Cable and shall meet or exceed IBM performance requirements for Type 1A cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMG per NFPA 70.

2.4 TELECOMMUNICATIONS OUTLET BOXES

Electrical boxes for telecommunication outlets shall be 4-11/16 inch square by 2-1/8 inches deep with minimum 3/8 inch deep single or two gang plaster ring as shown. Provide a minimum 1 inch conduit.

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Components shall be labeled in accordance with ANSI/TIA/EIA-606. Penetrations in fire-rated construction shall be firestopped in accordance with Section 07840 FIRESTOPPING. Conduits, outlets and raceways shall be installed in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Wiring shall be installed in accordance with ANSI/TIA/EIA-568-A and as specified in Section 16415 ELECTRICAL WORK, INTERIOR. Wiring, and terminal blocks and outlets shall be marked in accordance with ANSI/TIA/EIA-606. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Horizontal Distribution Cable

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Cables shall be installed in conduit. All cables shall be terminated; no cable shall contain unterminated elements. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.

3.1.2 Telecommunications Outlets

3.1.2.1 Faceplates

As a minimum each jack shall be labeled as to its function and a unique number to identify cable link.

3.1.2.2 Cables

Unshielded twisted pair cables shall have a minimum of 6 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturers bend radius for each type of cable shall not be exceeded.

3.1.2.3 Pull Cords

Pull cords shall be installed in all conduit serving telecommunications outlets which do not initially have fiber optic cable installed.

3.1.3 Terminal Blocks

Terminal blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Industry standard wire routing guides shall be utilized.

3.2 TERMINATION

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.

3.2.1 Unshielded Twisted Pair Cable

Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels. No cable shall be unterminated or contain unterminated elements. Pairs shall remain twisted together to within the proper distance from the termination as specified in ANSI/TIA/EIA-568-A. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket.

3.2.2 Shielded Twisted Pair Cable

Each cable shall be terminated on panel-mounted connectors. Cables shall be grounded at patch panels using manufacturer's recommended methods. Shield braid shall be continuous to connector braid terminator. Wire insulation shall not be damaged when removing shield.

3.3 GROUNDING

Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with ANSI/TIA/EIA-607 and Section 16415 ELECTRICAL WORK, INTERIOR. Equipment racks shall be connected to the electrical safety ground.

3.4 ADMINISTRATION AND LABELING

3.4.1 Labeling

3.4.1.1 Labels

All labels shall be in accordance with ANSI/TIA/EIA-606.

3.4.1.2 Cable

All cables will be labeled using color labels on both ends with encoded identifiers per ANSI/TIA/EIA-606.

3.4.1.3 Termination Hardware

All workstation outlets and patch panel connections will be labeled using

color coded labels with encoded identifiers per ANSI/TIA/EIA-606.

3.5 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

3.5.1 Unshielded Twisted Pair Tests

All metallic cable pairs shall be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room. Backbone wiring shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective communications closets. These test shall be completed and all errors corrected before any other tests are started.

3.5.2 Category 5e Circuits

All category 5e circuits shall be tested using a test set that meets the Class II accuracy requirements of TIA/EIA TSB 67 standard, including the additional tests and test set accuracy requirements of ANSI/TIA/EIA-568-A-5. Testing shall use the Basic Link Test procedure of TIA/EIA TSB 67, as supplemented by ANSI/TIA/EIA-568-A-5.. Cables and connecting hardware which contain failed circuits shall be replaced and retested to verify the standard is met.

3.5.3 Shielded Twisted Pair

Wiring configuration shall be tested for continuity, opens, shorts, swaps and correct pin configuration; dc resistance both pair-to-pair and wire-to-shield shall be verified. Cable lengths shall be verified. Near end crosstalk shall be tested from 772 kHz to 300 MHz. Ground potential difference between wiring closets, ground potential difference between patch panel and wall outlet, and ground path resistance shall be tested per IBM GA27-3361-07.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16711

TELEPHONE SYSTEM, OUTSIDE PLANT

03/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
- 1.3 QUALIFICATIONS
 - 1.3.1 Cable Installers
 - 1.3.2 Cable Splicing and Termination
 - 1.3.3 Manufacturers
- 1.4 SUBMITTALS
- 1.5 DELIVERY AND STORAGE
 - 1.5.1 Cable Requirements
 - 1.5.2 Equipment

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCTS
- 2.2 CABLE
 - 2.2.1 Copper Conductor Cable
 - 2.2.1.1 Underground
 - 2.2.1.2 Screened
- 2.3 CLOSURES
 - 2.3.1 Copper Conductor Closures
 - 2.3.1.1 Buried Closure
 - 2.3.1.2 Underground Closure
- 2.4 CABLE SPLICES AND ORGANIZERS
 - 2.4.1 Copper Cable Splices
- 2.5 CABLE TERMINALS
- 2.6 DUCT
 - 2.6.1 Duct/Conduit
- 2.7 EQUIPMENT RACKS
 - 2.7.1 Wall Mounted Cabinets
 - 2.7.2 Equipment Mounting Backboard
- 2.8 CONNECTOR BLOCKS
- 2.9 MISCELLANEOUS ITEMS
 - 2.9.1 Shield Connectors
 - 2.9.2 Grounding Braid
 - 2.9.3 Warning Tape
 - 2.9.4 Cable Warning Signs

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Cable Inspection and Repair
 - 3.1.2 Underground Cable
 - 3.1.2.1 Cable Pulling
 - 3.1.2.2 Penetrations for Cable Access
 - 3.1.2.3 Cable Bends
 - 3.1.3 Ducts
 - 3.1.3.1 Pull Rope
 - 3.1.4 Surge Protection
- 3.2 SPLICING
 - 3.2.1 Copper Conductor Splices
- 3.3 GROUNDING
 - 3.3.1 Incoming Outside Plant Cables
 - 3.3.2 Cable Stubs
 - 3.3.3 Shields
- 3.4 CUTOVER AND RECORDS
- 3.5 ACCEPTANCE TESTS
 - 3.5.1 Copper Conductor Cable

-- End of Section Table of Contents --

SECTION 16711

TELEPHONE SYSTEM, OUTSIDE PLANT

03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C62.61 (1993) Gas Tube Surge Arrestors on Wire
Line Telephone Circuits

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2239 (1996a) Polyethylene (PE) Plastic Pipe
(SIDR-PR) Based on Controlled Inside
Diameter

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA ANSI/EIA 455-81A-91 (1992) FOTP-81 Compound Flow (Drip) Test
for Filled Fiber Optic Cable

EIA ANSI/EIA/TIA-455-30B (1991) FOTP-30 Frequency Domain
Measurement of Multimode Optical Fiber
Information Transmission Capacity

EIA ANSI/EIA/TIA-455-53A (1990) FOTP-53 Attenuation by Substitution
Measurement for Multimode Graded-Index
Optical Fibers or Fiber Assemblies Used in
Long Length Communications Systems

EIA ANSI/EIA/TIA-455-78A-98 (1990; R 1998) FOTP-78 Spectral
Attenuation Cutback Measurement for Single
Mode Optical Fibers

EIA ANSI/TIA/EIA-568-A (1995) Commercial Building
Telecommunications Cabling Standard

EIA ANSI/TIA/EIA-607 (1994) Commercial Building Grounding and
Bonding Requirements for Telecommunications

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (1997) National Electrical Safety Code

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-85-625 (1996) Airecore, Polyolefin Insulated,
Copper Conductor Telecommunications Cable

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

RURAL UTILITIES SERVICE (RUS)

REA Bulletin 345-39 (1985) Telephone Station Protectors

REA Bulletin 345-50 (1979) Trunk Carrier Systems (PE-60)

REA Bulletin 345-65 (1985) Shield Bonding Connectors (PE-33)

REA Bulletin 345-72 (1985) Filled Splice Closures (PE-74)

REA Bulletin 345-151 (1989) Conduit and Manhole Construction,
REA Form 515c

REA Bulletin 1753F-205 (PE-39) (1993) Filled Telephone Cables

REA Bulletin 1753F-207 (PE-87) (1994) Terminating Cables

REA Bulletin 1753F-208 (1993) Filled Telephone Cables with
Expanded Insulation (PE-89)

RUS Bulletin 1751F-635 (1996) Aerial Plant Construction

RUS Bulletin 1751F-643 (1998) Underground Plant Design

RUS Bulletin 1753F-302 (PE-91) (1994) Outside Plant Housings and Serving
Area Interface Systems

RUS Bulletin 1753F-401(PC-2) (1995) Splicing Copper and Fiber Optic
Cables

RUS REA Bulletin 1751F-641 (1995) Construction of Buried Plant

RUS REA Bull 1753F-201 (PC-4) (1997) Acceptance Tests and Measurements
of Outside Plant

RUS REA Bull 1753F-601 (PE-90) (1994) Filled Fiber Optic Cables

RUS REA Bulletin 1755I-100 (1999) List of Materials Acceptable for
Use on Telecommunications Systems of RUS
Borrowers

UNDERWRITERS LABORATORIES (UL)

UL 50 (1995; Rev thru Oct 1997) Enclosures for
Electrical Equipment

UL 497 (1995; Rev Mar 1996) Protectors for Paired
Conductor Communication Circuits

1.2 SYSTEM DESCRIPTION

The outside plant system shall consist of all cable, conduit, etc. required to provide signal paths from the closest point of presence to the new facility, including free cabinets, backboards, terminating cables, lightning and surge protection module at the entry facility. The work consists of furnishing, installing, testing and making operational a complete outside plant system for continuous use.

1.3 QUALIFICATIONS

1.3.1 Cable Installers

Installation shall be under the direct supervision of an individual with a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.3.2 Cable Splicing and Termination

All cable splicers shall have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices shall be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

1.3.3 Manufacturers

The cable, equipment, and hardware provided shall be from manufacturers that have a minimum of 3 years experience in producing the types of cable, equipment, and hardware specified.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Spare Parts and Equipment List; FIO.

A data list of recommended spare parts, tools, and test equipment for each different item of material and equipment specified prior to beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Telephone System; FIO.

Detail drawings, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, and catalog cuts. Detail drawings shall also contain complete configuration information, wiring diagrams and any other details required to demonstrate that the cable system has been coordinated to support the transmission systems identified in the specifications and drawings. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operations.

Record Drawings; FIO.

Record drawings for the installed wiring system showing the actual location of all cable terminations, splices, routing, and size and type of all cables. The identifier for each termination and cable shall appear on the drawings. The drawings shall include gauge and pair or fiber count for each cable, duct and innerduct arrangement, or conductor assignment of outside plant, and protector and connector block layout at the termination points after installation.

SD-06 Instructions

Installation; FIO.

Printed copies of the manufacturer's recommendations for the material being installed, prior to installation. Installation of the item will not be allowed to proceed where installation procedures, or any part thereof, are required to be in accordance with those recommendations until the recommendations are received and approved.

SD-08 Statements

Acceptance Tests; FIO.

Test plans defining all tests required to ensure that the system meets specified requirements. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

Cutover and Records; FIO.

The cutover plan shall provide procedures and schedules for relocation of facility station numbers without interrupting service to any active location.

SD-09 Reports

Acceptance Tests; FIO.

Test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be

tabulated on a pair by pair or strand by strand basis.

SD-13 Certificates

Qualifications; FIO.

The qualifications of the manufacturer, splicer, and installation supervisor as specified.

1.5 DELIVERY AND STORAGE

1.5.1 Cable Requirements

All cable shall be shipped on reels. The diameter of the drum shall be large enough to prevent damage to the cable during reeling and unreeling. The reels shall be constructed to prevent damage during shipment and handling. The outer end of the cable shall be securely fastened to the reel head to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel, or into a housing on the inner slot of the drum, with sufficient length to make it available for testing. The inner end shall be fastened to prevent the cable from becoming loose during installation. End seals shall be applied to each of the cables to prevent moisture from entering the cable. The reels with cable shall be suitable for outside storage conditions when the temperature ranges from minus 40 to plus 148 degrees F, with relative humidity from 0 to 100 percent.

1.5.2 Equipment

All equipment shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants, in accordance with the manufacturer's requirements.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening. Each major component of equipment shall have the manufacturer's name and type identified on the equipment. All products supplied shall be specifically designed and manufactured for use with outside plant communications systems. All items of the same class of equipment shall be the products of a single manufacturer.

2.2 CABLE

2.2.1 Copper Conductor Cable

Copper conductor cable shall conform to the following:

2.2.1.1 Underground

Cable shall be manufactured per REA Bulletin 1753F-205 (PE-39) or REA Bulletin 1753F-208. A 8 mil coated aluminum or 5 mil copper metallic shield shall be provided.

2.2.1.2 Screened

Screened cable shall comply with REA Bulletin 1753F-205 (PE-39) or REA Bulletin 1753F-208.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Buried Closure

Buried closure shall conform to REA Bulletin 345-72.

2.3.1.2 Underground Closure

Underground closures shall conform to REA Bulletin 345-72. The closure shall be of thermoplastic, thermoset, or stainless steel material and be suitable for use in a vault or manhole.

2.4 CABLE SPLICES AND ORGANIZERS

2.4.1 Copper Cable Splices

All cables greater than 25 pairs shall be spliced using modular splicing connectors, which accommodate 25 pairs of conductors at a time. The correct connector size shall be used to accommodate the wire gauge of the cable to be spliced. The connectors used shall be listed in RUS REA Bulletin 1755I-100.

2.5 CABLE TERMINALS

2.6 DUCT

2.6.1 Duct/Conduit

Conduit shall be furnished as specified in Sections 16415 ELECTRICAL WORK, INTERIOR and 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and as shown on project drawings.

2.7 EQUIPMENT RACKS

Distribution frames, cabinets, and back-boards shall be provided as shown and designed to mount connector blocks, protector blocks, cross connects, and other hardware required to terminate and protect the outside telephone plant cable; to provide a demarcation point between inside and outside plant cable; and to allow inside and outside plant cable to be cross connected.

2.7.1 Wall Mounted Cabinets

Wall mounted cabinets shall conform to UL 50 and have boxes constructed of zinc-coated sheet steel with dimensions not less than shown on drawings. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum openings to the box interiors. Boxes shall be provided with 3/4 inch plywood backboard painted white or a light color. A duplex AC outlet shall be installed within the cabinet. Cabinet size shall be at least 30" H x 24" W x 6" D.

2.7.2 Equipment Mounting Backboard

Backboards shall be 3/4 inch AC plywood, sized as shown, painted with white or light colored paint.

2.8 CONNECTOR BLOCKS

Connector blocks consisting of flame-retardant molded plastic fastened to a metal mounting bar shall be provided to terminate the outside plant cable as shown. The connector blocks shall be of 100-pair block size and equipped with protection modules. The connector blocks shall be 24 gauge stub type. The cable stubs shall be 100 pair and conform to REA Bulletin 1753F-207 (PE-87).

2.9 MISCELLANEOUS ITEMS

2.9.1 Shield Connectors

Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire. The connector shall be made of tin-plated tempered brass. Shield bond connectors shall comply with REA Bulletin 345-65.

2.9.2 Grounding Braid

Grounding braid shall provide low electrical impedance connections for dependable shield bonding. The braid shall be made from flat tin-plated copper.

2.9.3 Warning Tape

Marking and locating tape shall be acid and alkali resistant polyethylene film, 6 inches wide with a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing, or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The metallic core shall be encased in a protective jacket or provided with other means to protect it from corrosion and shall be specifically manufactured for marking and locating underground utilities. The warning tape shall be orange in color and continuously imprinted with the words "WARNING - COMMUNICATIONS CABLE BELOW" at not more than 48 inch intervals.

2.9.4 Cable Warning Signs

Cable warning signs, which identify the route of buried cable, shall be stake mounted. The stake shall be driven into undisturbed soil and the

sign shall be mounted to the stake in accordance with the manufacturer's instructions. Warning signs shall be placed at intervals of no more than 500 feet and at each change of direction in the cable route. Warning signs shall also be placed on each side of every crossing of surface obstacles such as roads, railroads, stream crossings, or any similar crossing where excavation is likely to occur.

PART 3 EXECUTION

3.1 INSTALLATION

All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and as shown. All installation work shall be done in accordance with the safety requirements set forth in the general requirements of IEEE C2 and NFPA 70.

3.1.1 Cable Inspection and Repair

All cable and wire used in the construction of the project shall be handled with care. Each reel shall be inspected for cuts, nicks or other damage. All damage shall be repaired to the satisfaction of the Contracting Officer. The reel wrap shall remain intact on the reel until the cable or wire is ready to be placed.

3.1.2 Underground Cable

Underground cable installation shall be accomplished in accordance with the requirements set forth in RUS REA Bulletin 1751F-641.

3.1.2.1 Cable Pulling

For cable installed in ducts and conduit, a cable feeder guide shall be used, between the cable reel and the face of the duct and conduit, to protect the cable and guide it into the duct and conduit as it is paid off the reel. As the cable is paid off the reel, it shall be inspected for jacket defects. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. Cable shall be hand fed and guided through each manhole. As the cable is paid off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. Where the cable is pulled through a manhole, additional lubricant shall be applied at all intermediate manholes. Dynamometers or load-tension instruments shall be used to ensure that the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed upon a cable during installation shall not cause the cable to be twisted or stretched.

3.1.2.2 Penetrations for Cable Access

Penetrations in walls, ceilings or other parts of the building, made to provide for cable access, shall be caulked and sealed. Where conduits and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping

materials as specified in section 07840 FIRE STOPPING. Fire stopped penetrations shall not compromise the fire rating of the walls or floors. All underground building entries shall be through waterproof facilities.

3.1.2.3 Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter. Only large radius sweeps shall be used in conduit runs and shall not exceed a cumulative 90 degrees between manholes.

3.1.3 Ducts

Duct systems shall be installed in accordance with Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Manholes shall be placed in line with the main duct. Splice cases shall be mounted in the center on the long sides. Lateral conduits shall exit the long sides near the corners.

3.1.3.1 Pull Rope

Pull ropes of 3/8 inch polypropylene shall be installed in all unused ducts and inner-ducts with a minimum of 2 feet spare cord protruding from each end.

3.1.4 Surge Protection

Except for fiber optic cable, all cables and conductors, which serve as communication lines, shall have surge protection meeting the requirements of REA Bulletin 345-50 installed at the entry facility.

3.2 SPLICING

3.2.1 Copper Conductor Splices

Copper conductor cable splicing shall be accomplished in accordance with RUS Bulletin 1753F-401(PC-2). Modular splicing shall be used on all cables larger than 25 pairs.

3.3 GROUNDING

Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals shall be grounded. Grounding shall be in accordance with requirements of NFPA 70, Articles 800-33 and 800-40.

3.3.1 Incoming Outside Plant Cables

All incoming outside plant cable shields shall be bonded directly to the TMGB or the closest TGB.

3.3.2 Cable Stubs

All shields of cable stubs shall be bonded to a TGB located on the frame.

3.3.3 Shields

The shields of all incoming cables shall not be bonded across the splice to the cable stubs.

3.4 CUTOVER AND RECORDS

All necessary transfers and cutovers, shall be accomplished by the Contractor.

3.5 ACCEPTANCE TESTS

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test; testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. The test plans shall define all the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

3.5.1 Copper Conductor Cable

The following acceptance tests shall be performed in accordance with RUS REA Bull 1753F-201 (PC-4):

- a. Shield continuity.
- b. Conductor continuity.
- c. Conductor insulation resistance.
- d. Structural return loss.
- e. Cable insertion loss and loss margin at carrier frequencies.
- f. Shield ground for single jacketed cables.
- g. DC loop resistance.

-- End of Section --